



Collision and fall rates by regular cyclists on bicycle facilities

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1. Introduction

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- **Increase in cycling in French cities** (Papon and De Solère, 2010; Ravalet and Bussiere, 2012; Richer and Rabaud, 2019)
- **Public spaces** have been subject to significant **redevelopment**, for a **better sharing of space between different transport modes**
- **Great variety of tools** : cycle lanes, cycle tracks, contraflow cycle lanes, shared bus lanes, greenway, etc.
- **Effects of bicycle facilities** on safety are **unclear** (Gårder et al., 1994 ; Elvik et Vaa, 2004 ; DiGioia et al., 2017; Reynolds et al., 2009 ; Thomas and DeRobertis, 2013) and it is a **controversial issue in scientific literature**
- Rate of injuries is **higher on cycle tracks than on-road** in **Toronto** and **Ottawa** (Aultman-Hall and Hall, 1998 ; Aultman-Hall and Kaltenecker, 1999)
- The **objective** of the present study is to **estimate crash rates of cyclists on different bicycle facilities** and to find out whether **Toronto and Ottawa trends** are also observed in the **European context**



*Bicycle path Prado Avenue, Marseille
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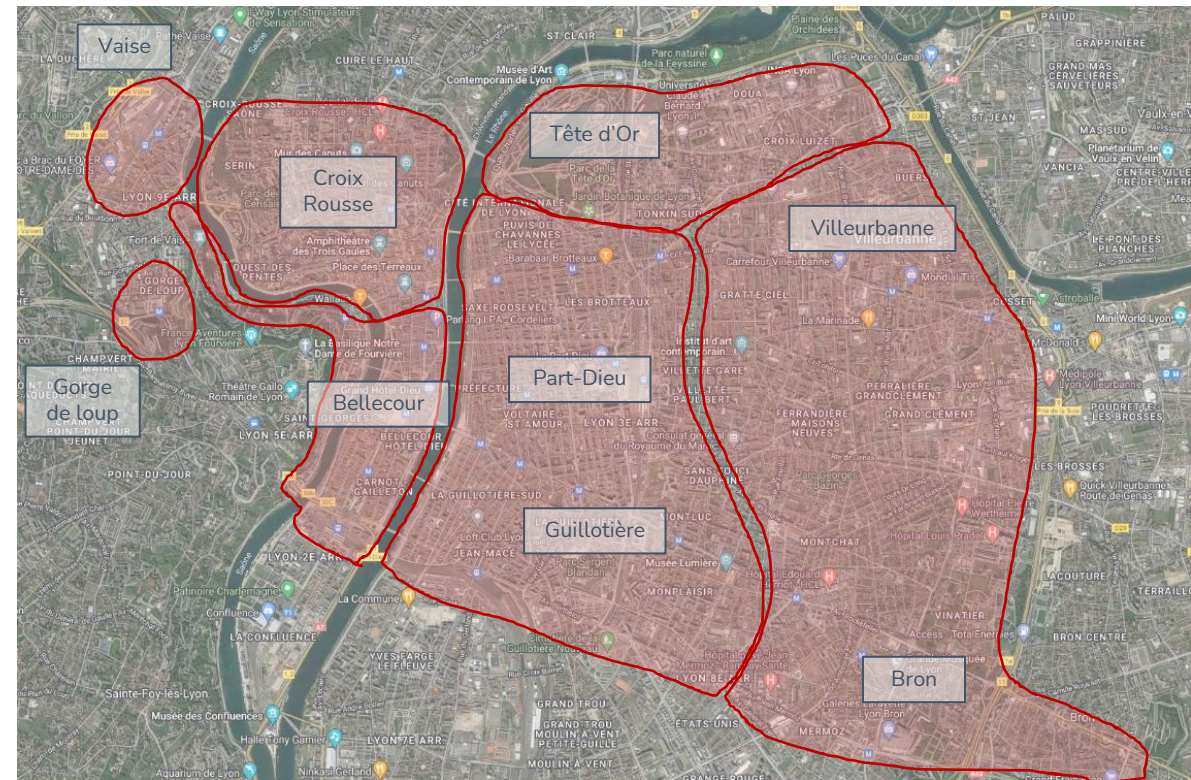
2. Methodology

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- July to October 2021 : 3 000 copies of questionnaire
- Various districts in Lyon center :
- A variety of types of distribution locations : universities, central business districts, metro and train stations, etc.
- A postage-paid return envelope and a questionnaire including a map
- An online version of the survey was sent to cyclists : Limesurvey and Framacarte



Distribution of surveys in Lyon,
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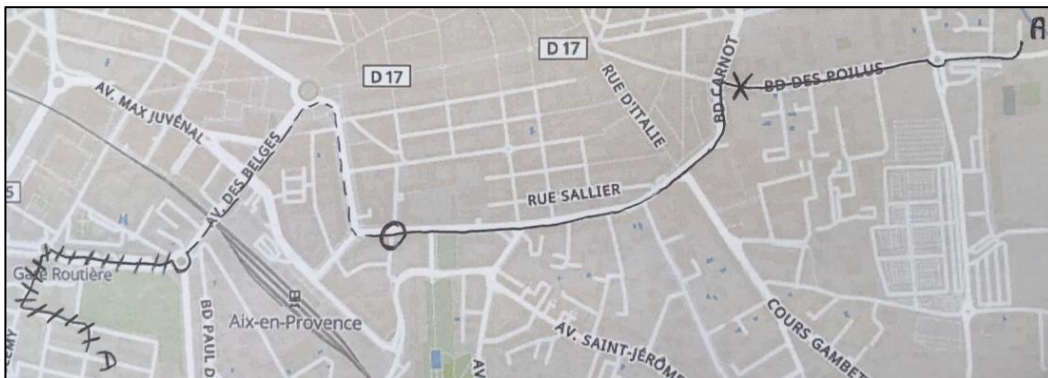


Distributions areas in Lyon, © Pierre-Jean Pillonnet , 2022

2. Methodology

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- The questionnaire was divided into **three parts** :
 - Travel habits
 - The **most regular trip** made by bicycle
 - Crash experience
- **Travel's length** on each infrastructure type was obtained in Qgis → determine **travel exposure on different facilities** for the last 2 years
- **Event rate** for each facility = **number of incidents on a specific facility / total amount of kilometers traveled** on that same infrastructure (travel exposure)



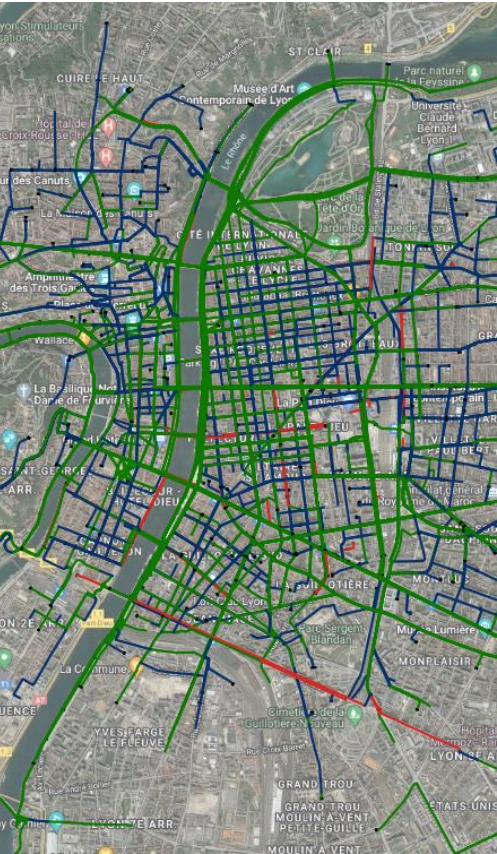
The accident table used in the questionnaire,
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A map filled in by a cyclist,
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	COLLISION 1	COLLISION 2
20/ Avec quel usager, la collision a-t-elle eu lieu ?		
une automobile		
un camion		
un bus		
un vélo		
un deux-roues motorisé		
un piéton		
un engin de déplacement personnel (trottinette, hoverboard, monoroue, etc.)		
un animal		
Autre (précisez)		
21/ Sur quel type d'infrastructure s'est produite la chute ?		
sur la route		
sur une bande cyclable		
sur une piste cyclable		
sur un double sens cyclable : rue autorisée dans les deux sens pour les cyclistes, aussi appelé contre sens cyclable		
dans un couloir de bus / vélo		
sur le trottoir		
sur une piste covid		
autre (précisez)		
22/ La chute s'est-elle produite à une intersection ?		
oui		
non		
23/ Quels types de blessures avez-vous subies ?		
aucune		
mineure		
hospitalisé(e) moins de 24h		
hospitalisé(e) plus de 24h		
24/ La chute a-t-elle été déclarée aux forces de l'ordre ?		
oui		
non		

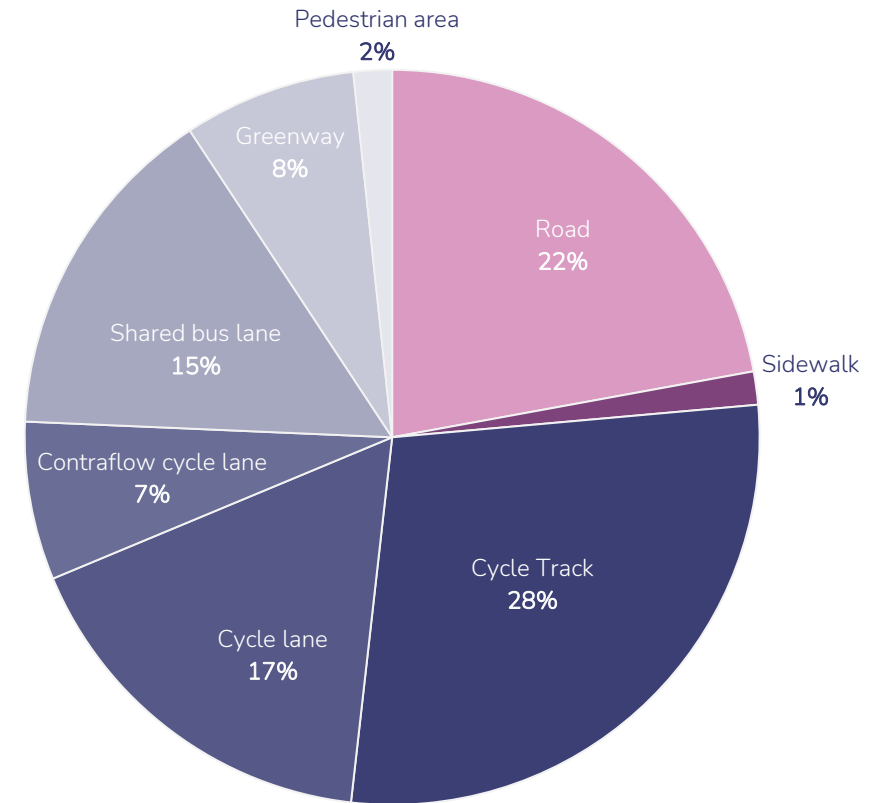
3. Results

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Cyclists' routes in Lyon city center, © Pierre-Jean Pillonnet , 2022

- 865 questionnaires were returned and 780 were included in the analysis
- The sample contains :
 - 51 % of women and 49% men
 - 34 % of participants are 30 to 39 years old
 - 13 % of cyclists riding an electric bike
 - 90 % of commuters
- Cyclists were involved in :
 - 274 crashes : 188 collisions and 86 falls
 - 119 crashes with injury
- Average length of one-way trip : 3.25 km
- Cyclists' trips were travelled on
 - Sidewalk (1 %)
 - Road (22 %)
 - Bicycle facilities (76 %)



Bicycle facilities used by bycyclists in Lyon, © Pierre-Jean Pillonnet , 2022

3. Results

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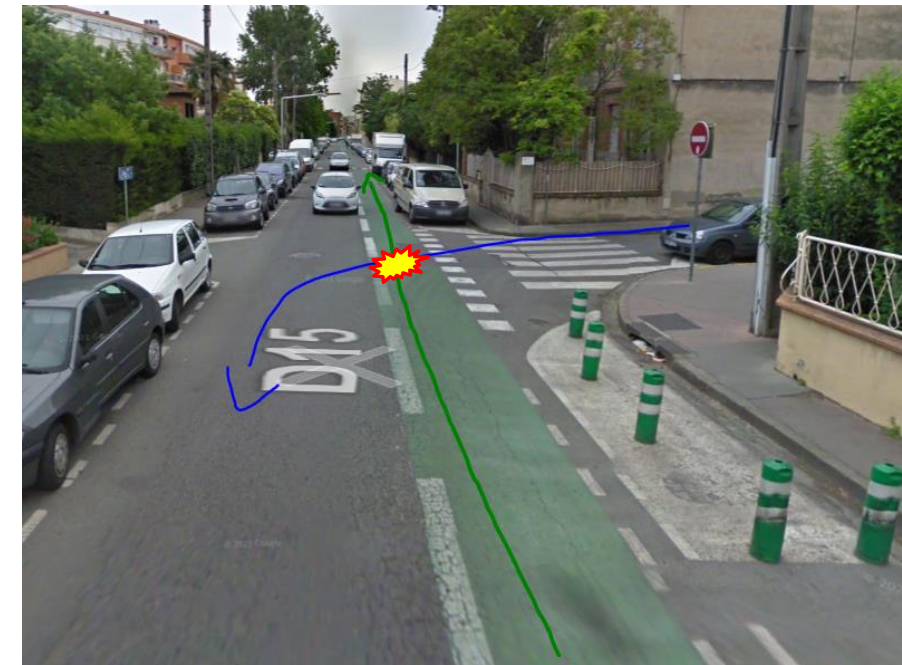
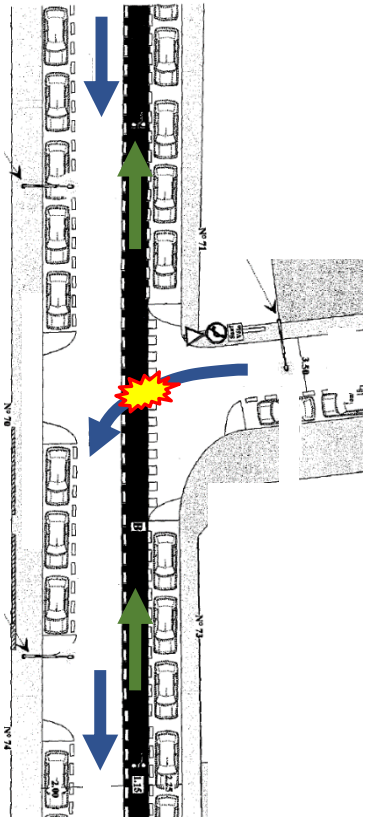
- Overall event rate is **35.83** crashes per 100 000 km = 1 crash every 2 791 km
- Relative **rate of collision on bicycle facilities** is **significantly higher than on road** :
→ It is **1.51** times greater
- Relative **rate of collision and fall on contra-flow cycle lanes** are **significantly higher than on road** :
→ They are **2.21** and **3.11** times greater

Relative rate for	Event	Relative risk	Lower 95% confidence interval	Upper 95% confidence interval
Travel on bicycle facility to travel on road	Collision	1.51	1.03	2.22
	Fall	0.85	0.52	1.39
	Injury	0.87	0.57	1.32
Travel on contraflow cycle lane to travel on road	Collision	2.21	1.28	3.82
	Fall	3.11	1.72	5.62
	Injury	1.14	0.57	2.28

4. Discussion and conclusion

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- Excess collision risk on bicycles facilities :
 - Cycling discontinuities and intersections issues
 - Increase of cyclists in Lyon
- Rates of collision and fall on contraflow cycle lane are greater than on roads :
 - This bicycle facility may cause **inappropriate motorist expectations**, in particular at intersections
 - Contraflow cycle lane are **frequent in narrow streets**
- Limits :
 - Survey focused on the **central part of Grand Lyon**
 - **Minor crashes**



Accident analysis sheet in Toulouse, © Pierre-Jean Pillonnet , 2022

- This research sheds light the **debate on bicycle facilities mixed safety effects**, highlighting **infrastructure design importance**



Thank you!

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References

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- Amoros, E., Chiron, M., Ndiaye, A., Thélot, B., Laumon, B., 2009. Cyclistes Victimes d'Accidents (CVA), Partie 1: caractéristiques et bilan lésionnel. INRETS, Lyon, pp. 83.
- Blaizot, S., Papon, F., Haddak, M.M., Amoros, E., 2013. Injury incidence rates of cyclists compared to pedestrians, car occupants and powered two-wheeler riders, using a medical registry and mobility data, Rhône County, France. *Accident Analysis & Prevention* 58, 35–45.
- Boström, L., Nilsson, B., 2001. A Review of serious injuries and deaths from bicycle accidents in Sweden from 1987 to 1994. *Journal of Trauma and Acute Care Surgery* 50, 900–907.
- Brenac, T., Millot, M., 2002. Incidences des choix de planification urbaine sur l'insécurité routière. Revue critique de quelques résultats., in: *Gestion urbaine, sécurité routière et environnement: actes des séminaires du projet SEGUR 2001 - 2002*, Actes INRETS. INRETS, Arcueil, pp. 222.
- Chen, L., Chen, C., Srinivasan, R., McKnight, C.E., Ewing, R., Roe, M., 2012. Evaluating the Safety Effects of Bicycle Lanes in New York City. *American Journal of Public Health* 102, 1120–1127.
- DiGioia, J., Watkins, K.E., Xu, Y., Rodgers, M., Guensler, R., 2017. Safety impacts of bicycle infrastructure: A critical review. *Journal of Safety Research* 61, 105–119.
- Elvik, R., Vaa, T. (Eds.), 2004. *The handbook of road safety measures.*, 1st edition. ed. Emerald Group Pub Ltd, Amsterdam, pp. 1078.
- Gårder, P., Leden, L., Thedéen, T., 1994. Safety implications of bicycle paths at signalized intersections. *Accident Analysis & Prevention* 26, 429–439.
- Jensen, S.U., 2008. Bicycle tracks and lanes: a before-and-after study. 87th Annual meeting of the Transportation Research Board, Washington, DC, pp. 16.
- Levine, N., Kim, K.E., Nitz, L.H., 1995. Spatial analysis of Honolulu motor vehicle crashes: I. Spatial patterns. *Accident Analysis & Prevention* 27, 663–674.
- Métropole de Lyon, 2019. Guide pour la conception des aménagements cyclables. Grand Lyon, pp 191.
- Nabavi Niaki, M.S., Saunier, N., Miranda-Moreno, L.F., 2019. Is that move safe? Case study of cyclist movements at intersections with cycling discontinuities. *Accident Analysis & Prevention* 131, 239–247.
- Parkin, J., Meyers, C., 2010. The effect of cycle lanes on the proximity between motor traffic and cycle traffic. *Accident Analysis & Prevention* 42, 159–165.
- Papon, F., De Solère, R., 2010. Les modes actifs: marche et vélo de retour en ville. Commissariat général au développement durable – Services de l'observation et des statistiques, La Revue, 65–82.
- Pulugurtha, S.S., Thakur, V., 2015. Evaluating the effectiveness of on-street bicycle lane and assessing risk to bicyclists in Charlotte, North Carolina. *Accident Analysis & Prevention* 76, 34–41.
- Ravalet, E., Bussiere, Y., 2012. Les systèmes de vélos en libre-service expliquent-ils le retour du vélo en ville? *Recherche Transports Sécurité* 28, 15–24.
- Reynolds, C.C., Harris, M.A., Teschke, K., Crompton, P.A., Winters, M., 2009. The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature. *Environmental Health* 8, 47.
- Richer, C., Rabaud, M., 2019. L'évolution des mobilités actives dans la Métropole Européenne de Lille depuis dix ans: changement de modèle ou prolongement de tendance? *Belgeo. Revue belge de géographie* 4.
- Rivara, F.P., Thompson, D.C., Thompson, R.S., 1997. Epidemiology of bicycle injuries and risk factors for serious injury. *Injury Prevention* 3, 110–114.
- Summala, H., Pasanen, E., Räsänen, M., Sievänen, J., 1996. Bicycle accidents and drivers' visual search at left and right turns. *Accident Analysis & Prevention* 28, 147–53.
- Thomas, B., DeRobertis, M., 2013. The safety of urban cycle tracks: a review of the literature. *Accident Analysis & Prevention* 52, 219–27.
- UrbaLyon, 2020. Transports et déplacements, les chiffres clés 2019, UrbaLyon, Lyon, pp. 16.

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