



7th IRTAD Conference: Better Road Safety Data for Better Safety Outcomes
27 - 28 September 2022 , Lyon , France , International Transport Forum

Data for evidence:

**Overcoming the problem of insufficient information on accidents involving new forms of active mobility
by generating specific data as a basis for evidence-based analyses.
The example of accidents with electric bicycles**



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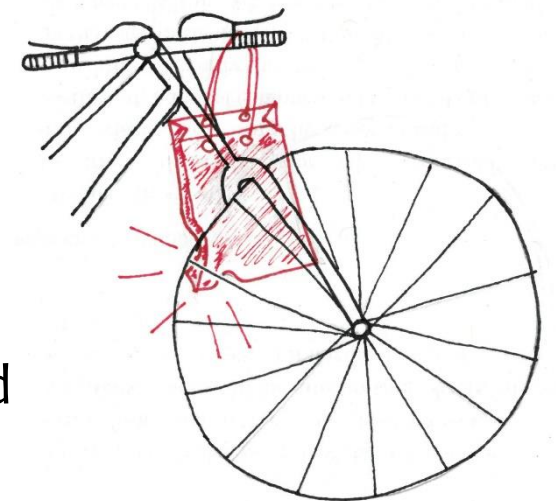
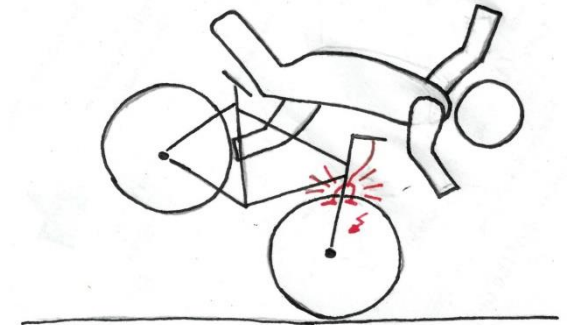
at TU Dortmund University

Department of Transport Planning





- Bicycle experiencing renaissance & Pedelec boosting this trend
- With growing number of pedelecs, potential of conflict increases
- most pedelec accident analysis based on standardised accident data but: initially designed for double-track motor vehicles
- Official statistics build important fundament for accident analysis but: important, bicycle/pedelec-specific information not collected
- Barrier: bicycle-specific categories of accidents cannot be analysed
- However, accident statistics most important basis for evidence-based measures in road safety work





Two different datasets analysed:

1. **Official accident statistics**
2. **Accident text descriptions** written by police on site
 - provided by German polices as special data set
 - included 6,253 accidents with pedelecs from 2016 and 2017
 - covering 68 % of all police recorded pedelec accidents in this period

Preliminary research showed:

- Special data set representative
- Pedelec single accidents different
 - separate evaluation and publication ^[1]



- first objective: define **new, pedelec-specific characteristics**
- second objective: analyse these newly created categories
- This presentation deals with first objective:
 - shows how new, pedelec-specific categories can be identified
 - Including brief overview of quantitative analysis
- More detailed quantitative analysis (frequencies / severities) in winter 2022/2023



- 1. Defining new categories** → literature analysis to cover all pedelec specific aspects
- 2. First screening** → data viewed and sorted by experts
- 3. Draft of new features** → based on first screening, literature analysis, previous findings and presumed focal points
- 4. Partitioning of accident data** → data set (4,196 cases) randomly assigned to two experts
- 5. Quality assurance** → 5 % of the cases categorised by both experts to quantify differences
- 6. Test phase** → daily discussion & revisions. Afterwards systematology of new categories fixed
- 7. Categorisation** → all 4,196 accidents assigned to one or more categories
- 8. Final data set** → datasets merged back, results checked for plausibility & completeness



- 13 new, pedelec-specific accident categories have been defined
- mostly subdivided into further sub-categories
- 12 new accident categories describing accident causes
- 1 additional new category describing area pedelec used during conflict

Sample dat set: accidents with personal injury involving two or more road users (including at least one pedelec) in the period 2016-2017

Block	categories	sub-categories	Number of accidents	number of pedelec users injured...				
				total	fatally	seriously	slightly	accident severity*
0	total		4,196	3,958	52	921	2,985	232
1	Traffic area used by pedelec before collision:							
	Walking/cycling facility (GRVA)		1,919	1,803	14	371	1,418	201
	GRVA structurally separated: footway		220	196	3	32	161	159
	GRVA structurally separated: cycle path		1,042	990	7	202	781	201
	GRVA struc. sep.: shared foot- & cycle path		439	409	1	96	312	221
	GRVA on carriageway: cycle lane		218	208	3	41	164	202
2	Road lane (without cycling facility)		2,277	2,155	38	550	1,567	258
	Addition: on cycle facility in wrong direction		282	260	1	38	221	138
	Addition: GRVA (was free for both directions)		498	469	4	88	377	185
	Distance too short**		1,028	932	7	257	668	257
3	Pedelec		470	399	1	123	275	264
	Opponent		683	640	6	156	478	237
4	Pedelec driving error: stuck/touched...		306	265	2	73	190	245
	Motor vehicle		82	78	1	19	58	244
	Bicycle/Pedelec		166	145	0	42	103	253
	Pedestrian		44	28	1	6	21	159
	Obstacle/other		14	14	0	6	8	429
5	Conflict with parked motor vehicle**		260	253	0	44	209	169
	Motor vehicle opening door ("dooring")		132	129	0	24	105	182
	Motor vehicle manoeuvring in/out parking space		110	107	0	15	92	136
	Motor vehicle on cycle lane		26	25	0	5	20	192
6	Violating red light**		78	74	1	29	44	385
	Pedelec		50	46	0	23	23	460
	Opponent		32	31	1	7	23	250
7	Disregarded right of way		1,313	1,259	18	301	940	243
	Pedelec		286	274	16	108	150	434
	Opponent		1,027	985	2	193	790	190
8	Conflict with animals		62	60	0	19	41	306
	Motor vehicle/bicycle overlooks pedelec		2,451	2,376	17	430	1,929	182
	Pedelec from left		518	504	4	105	395	210
	Pedelec from right		741	715	5	119	591	167
	Pedelec from rear right (blind spot)		293	288	3	58	227	208
	Pedelec from rear left (blind spot)		178	172	0	29	143	163
	Pedelec from opposite direction		464	448	3	85	360	190
	Pedelec from unclear direction		257	249	2	34	213	140
9	Carelessness of pedelec user**		377	359	7	130	222	363
	Overlooked		198	184	4	73	107	389
	Mobile phone		3	2	0	0	2	-
	Others		235	233	6	75	152	345
10	Falling without collision**		354	338	2	45	291	133
	Falling due to evasive manoeuvres		152	141	1	21	119	145
	Falling due to problems with brakes or braking		213	208	1	24	183	117
11	Poor hand signal		81	73	3	35	35	469
	Cut curve**		132	123	1	30	92	235
	Pedelec		45	41	0	14	27	311
12	Opponent		89	82	1	16	65	191
	Cut after overtaking		124	119	3	30	86	266
	Pedelec		18	13	0	4	9	222
	Opponent		106	106	3	26	77	274
	Pedelec lane change		76	72	2	20	50	289
	Pedelec lane crossing		76	73	5	25	43	395
13	Motor vehicle crossing cycle lane		5	5	0	2	3	-
	Roundabout		130	125	1	30	94	238
	Property entrance (garage driveway, etc.)		596	577	4	83	490	146

*Accident severity: fatally and seriously injured pedelec users per 1,000 accidents involving a pedelec. No calculation of accident severity if less than: 10
 ** Multiple answers possible



most frequent conflicts:

- pedelec is **overlooked** by opponent (59%)
- road users (mostly opponents) **disregarded** the **right of way** (31%)
- road users (more often the opponents) **misjudged** the **space required** (25%)

pedelec user **mostly** (75%) **not mainly responsible**, but **if, severity** significantly **higher**

highest accident severity when pedelec user:

- **violated red light**
- did **not** give (proper) a **hand signal** when changing direction
- **disregarded** the **right of way**
- **stuck on** an **obstacle** or touched it

In almost **half** (46%) of all accidents, pedelec riding on pedestrian and/or **cycle facility** during conflict
→ **severity** significantly **lower** than for accidents on carriageway



4,196 accident descriptions (with at least two road user) **read & analysed**

Qualitative analysis:

- made it possible to **create thirteen new pedelec-specific categories** (with additional subcategories) that do not exist in the standardised accident statistics to this extend
- With **new categories** possible to take **closer look** at this problem
- Possibility to **verbalise conflicts**

Quantitative analysis:

- Pedelecs often not seen
→ **Better visibility of pedelecs appears to be priority**
- Highest accident severities related to pedelec user errors
→ **Raising awareness among pedelec users a second priority**
- Accidents on cycling facilities significantly less severe
→ highlights **expansion of safe cycling infrastructure as third priority**

Results provide pedelec-specific information

→ can be used as **basis** for **analysing** the **need** of **new requirements/measures** for road safety work

Further Information on Accidents involving Pedelecs

- Paper to this presentation (in English): fersi.org

Panwinkler, T. (2022): Data for evidence: Overcoming the problem of insufficient accident information - The example of electric bicycle accidents.

- Peer reviewed paper comparing accidents of pedelecs and conventional bicycles (in German):

Panwinkler, T., C. Holz-Rau (2019): Unfallgeschehen von Pedelecs und konventionellen Fahrrädern im Vergleich: Pedelec vs. Fahrräder. In: Zeitschrift für Verkehrssicherheit 65 (05), 336–347



- Presentation (in English) at International Cycling Safety Conference 2021:

https://youtu.be/ES2vAW_rQjo



- Peer reviewed paper about causes of pedelec single accidents: doi.org/10.1016/j.aap.2021.106082

Panwinkler, T., C. Holz-Rau (2021): Causes of pedelec (pedal electric cycle) single accidents and their influence on injury severity. In: Accident Analysis & Prevention Volume 154, May 2021.

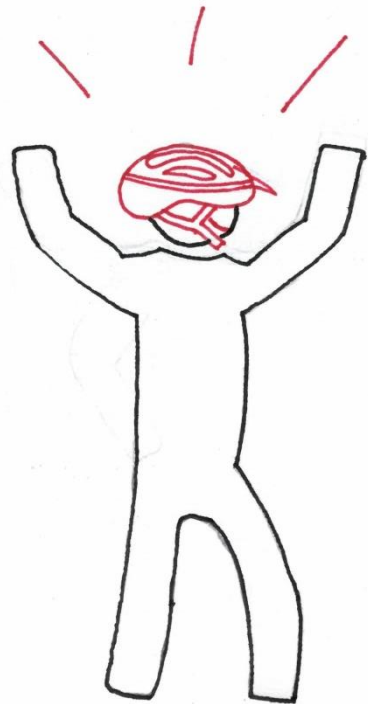


- Science Slam (in German): <https://youtu.be/gzbcI66aPIE>

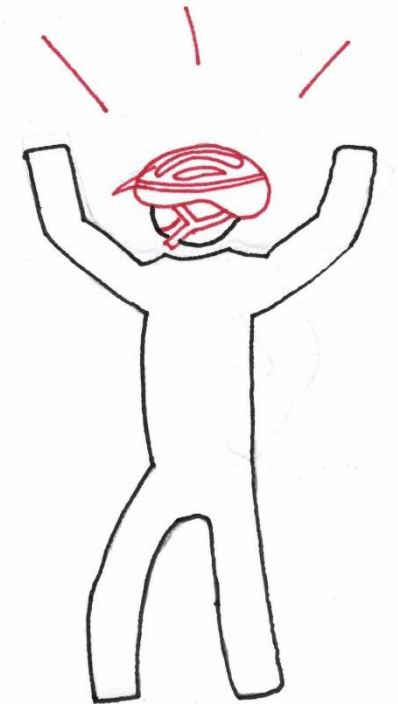
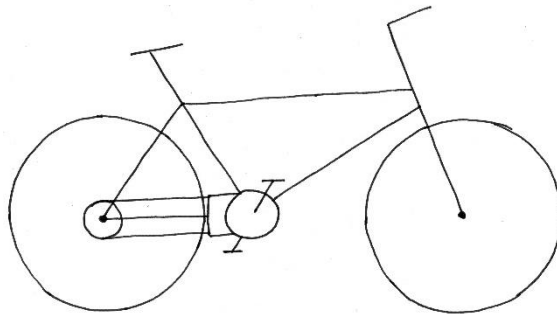


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Any questions? Please ask!
Otherwise: enjoy cycling!



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