

### Weight data from ATK points

A solid base for weight statistics?

## Vektdata fra ATK-punkt

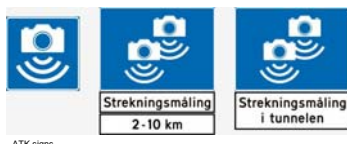
Kan disse benyttes til vektstatistikk?

Norwegian University of Science and Technology

 NTNU

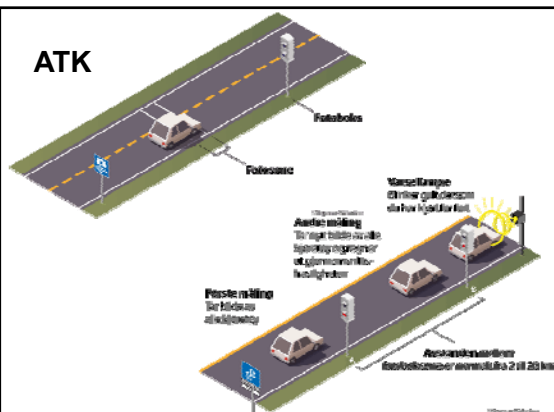
**ATK**

- Used for speed enforcement in Norway
- Wide coverage (250 units) across the whole country
- Operated with piezo electrical cables
- Could ATK weight data be used for WIM purposes?



### ATK signs

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**ATK Punkt**

- Consist out of a camera unit and two piezo electrical cables



Piezo elektriske kabler på E18 Dordal



Kamera på E18 Dordal

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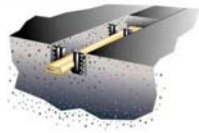
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**Data kvalitet**

- AxSpeed 100 / 200 DataRec 410
- Round / flat piezoelectric cables
- Pavement / ground consistency
- Vehicle movement characteristics



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**Field studies**

- Preliminary tests indicated that ATK data could indeed be used for WIM purposes
- Ongoing large scale field tests in different regions across the entire country



Truck weight control E6 Asen / Nord-Trøndelag



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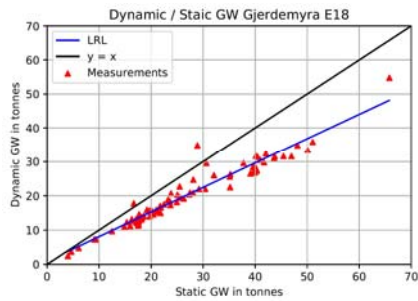
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Result field study Gjerdemyra E18



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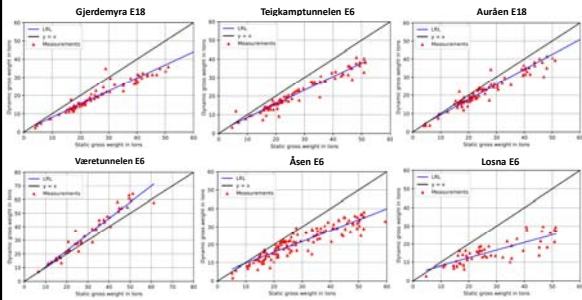
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Overview Results Field-tests



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Characteristically Vehicle Class



7t

- 7 tons as stable quality indicator
- Introduced by van Loo & Lees (2015)
- Test with Kistler Verdral / Trøndelag (E6) 2016

	All 6ax			SEMI		
	Mean in t	STD in t	N	Mean in t	STD in t	N
Kistler Verdral E6	6.998200	0.988884	76 559	6.944768	0.866792	36 454

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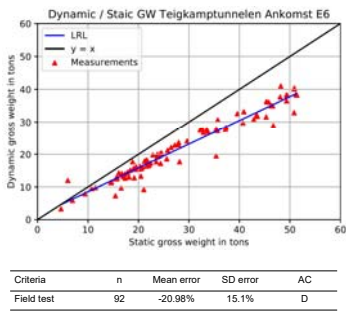
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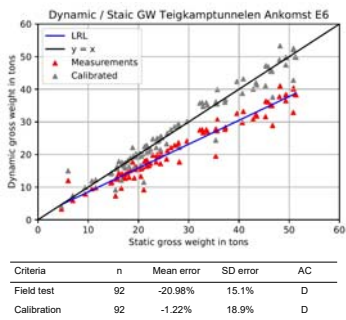
Teigkamptunnel E6 Oppland



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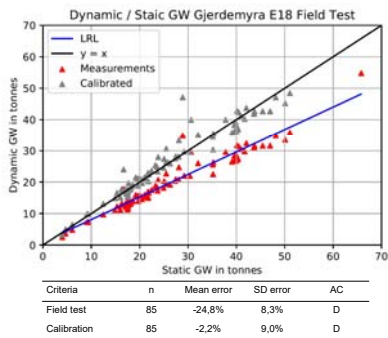
Teigkamptunnel E6 Oppland



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Gjerdemyra E18 Telemark




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### Preliminary Findings

ATK  
Field-tests

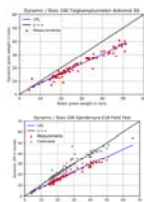


Calibration  
Method



7t  
COST 323  
Accuracy Classes

Promising  
Results



➤ Demands of potential data users

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### Demands of users

- Average amount of
  - Single axles
  - Bogie axles
  - 3-bogi axles
- Weight distributions
  - Single axles
  - Bogie axles
  - 3-bogi axles
- Tire pressure
- Share of super single wheels
- Stability over time



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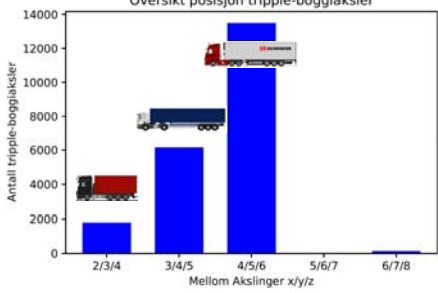
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### Number of 3-bogie axles

(Storsandtunnel / Sør-Trøndelag E39)

Oversikt posisjon tripple-boggiaksler



Antall tripple-boggiaksler

Mellom Akslinger x/y/z

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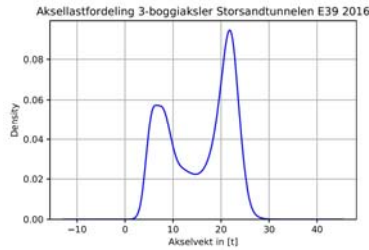
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### Distribution of 3-bogie axes

(Storsandtunnel / Sør-Trøndelag E39)



	Antall	Mean in t	STD in t	Tillatt max. Vekt in t
3-boggi	21 557	15.49	6.71	24

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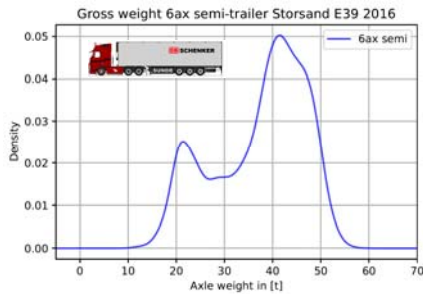
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### Gross weight 6ax semi-trailer

(Storsandtunnel / Sør-Trøndelag E39)



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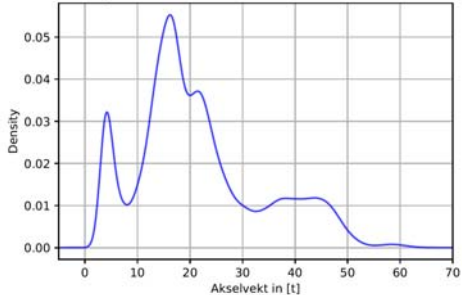
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### Totalvekt 6ax Lastebiler

Grossweight vehicles > 3.5t Storsandtunnelen E39 Trøndelag



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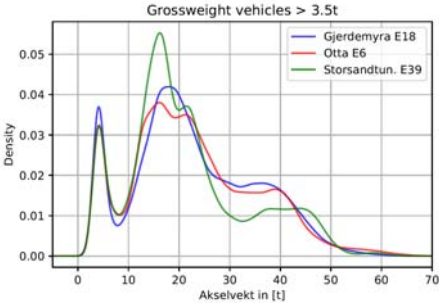
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Gross weight vehicles >3.5t



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Tungbil? 3,5t vs. 5,6m

- Forskjeller i kategorisering av lastebiler
- Lenge vs. vektbaserte systemer

Kontrollsted	Kjoretøyer	Aks. pr Kjt.	Lastebiler	Aksler	Aks. pr L.	% tunge	% Datainn
Storsand E39	1 436 097	2.18	130 221	474 364	3.72	9.0 %	12 %
Gjerdemyra E18	1 708 376	2.47	237 902	1 076 614	4.52	13.9 %	18 %
Otta Sør E6	1 430 387	2.32	203 691	846 550	4.16	14.2 %	19.0 %
Teigskamptunnelen E6 (A)	344 082	2.49	59 699	264 953	4.44	17.4 %	~ 22.6%
Teigskamptunnelen E6 (B)	338 531	2.48	57 681	256 475	4.45	17.0 %	~ 22.6%
Verdal E6 (KIST.)	2 792 707	2.21	250 511	1 038 187	4.11	9.0 %	12.7 %

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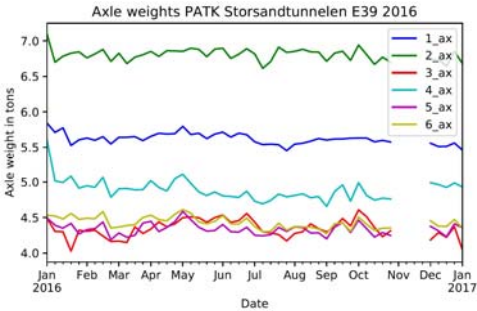
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Storsandtunnelen E39 Sør-Trøndelag



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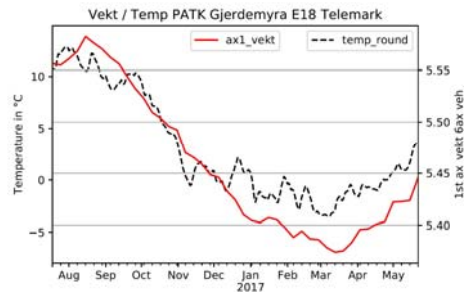
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Gjerdemyra E18 Telemark

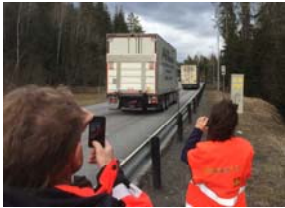


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Conclusions

- ATK weight signals could indeed be used for WIM
- Demand for data
- Further error evaluation needed
- Run further field tests



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Center

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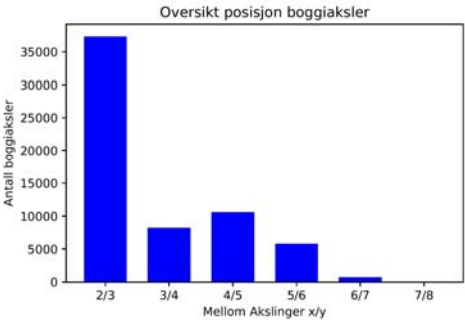
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Boggiaksler

(Storsandtunnel / Sør-Trøndelag E39)



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Boggiaksler

(Storsandtunnel / Sør-Trøndelag E39)



	Antall	Mean in t	STD in t	Tillatt max. Vekt in t
Boggi	62 188	12.54	4.51	18

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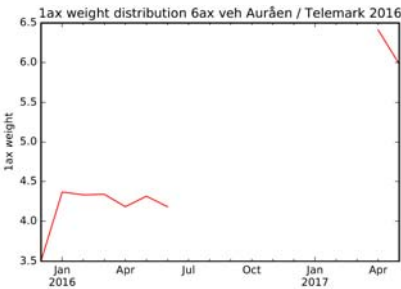
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Gjerdemyra E18 Auråen



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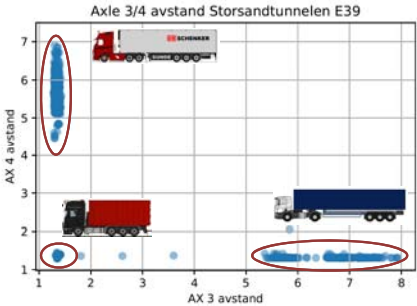
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Kategorisering



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2 / 3-boggi per lastebil [C<sub>v</sub> = individuell]

- Bruk av utviklet kalibreringsmetodikk
- % boggi aksler per lastebil

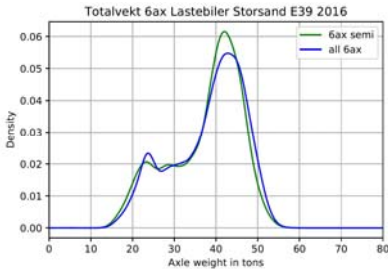
Kontrollsted	Kjøretøyer	Lastebiler	% Lastebiler	2-boggi	% 2-boggi	3-boggi	% 3-boggi
Storsand E39	1 436 097	120 888	8.42 %	83 477	69.05 %	21 637	17.90 %
Gjerdemyra E18	1 708 369	234 125	13.70%	175 589	75.00 %	77 316	33.02 %
Auråsen E18	815 496	120 974	14.83 %	89 385	73.89 %	38 517	31.84 %
Olta Sør E6	1 430 387	197 008	13.77 %	153 425	77.88 %	54 080	27.45 %
Teigskamptunnelen E6 (A)	344 082	59 209	17.21 %	47 825	80.77 %	17 961	30.33 %
Teigskamptunnelen E6 (B)	338 531	60 218	17.79 %	46 724	77.59 %	17 431	28.95 %

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Totalvekt 6ax Lastebiler

(Storsandtunnel / Sør-Trøndelag E39)

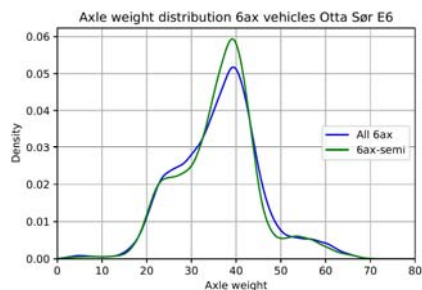


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## Totalvekt 6ax Lastebiler

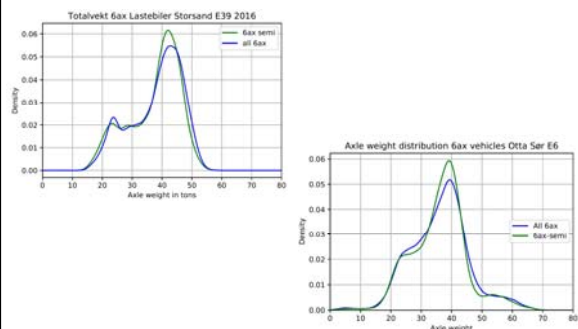
(Otta Sør / Oppland E6)



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## Totalvekt 6ax Lastebiler



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## 2 / 3-boggi per lastebil [ $C_v$ = individuell]

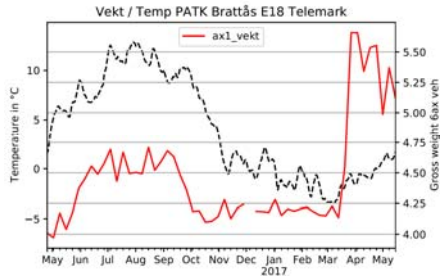
- Bruk av utviklet kalibreringsmetodikk
- % boggi aksler per kjøretøy

Kontrollsted	Kjøretøyer	Lastebiler	% Lastebiler	2-boggi	% 2-boggi	3-boggi	% 3-boggi
Storsand E39	1 436 097	120 888	8.42 %	83 477	5.81 %	21 637	1.51 %
Gjerdemyra E18	1 708 369	234 125	13.70 %	175 589	10.28 %	77 316	4.53 %
Auråsen E18	815 496	120 974	14.83 %	89 385	10.96 %	38 517	4.72 %
Otta Sør E6	1 430 387	197 008	13.77 %	153 425	10.73 %	54 080	3.78 %
Teigskamptunnelen E6 (A)	344 082	59 209	17.21 %	47 825	13.90 %	17 961	5.22 %
Teigskamptunnelen E6 (B)	338 531	60 218	17.79 %	46 724	13.80 %	17 431	5.15 %
Gjennomsnitt							

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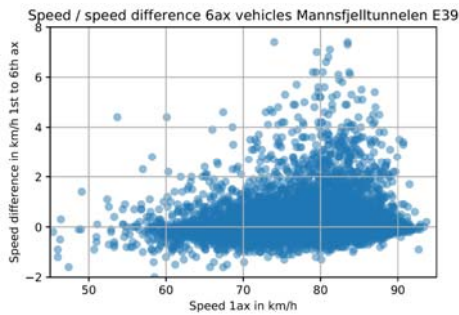
Gjerdemyra E18 Brattås



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Mannsfjell E39 Trøndelag



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Mannsfjell E39 Trøndelag

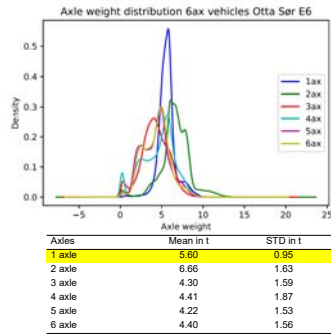
Δ speed	All 6ax			SEMI		
	Mean in t	STD in t	N	Mean in t	STD in t	N
All	5.737110	0.641877	34 551	5.693562	0.567009	23 641
0.0 ≤ Δ < 0.5	5.727249	0.627145	17 773	5.680465	0.559049	12 511
0.5 ≤ Δ < 1.0	5.966780	0.692938	1 177	5.939636	0.612287	825
1.0 ≤ Δ < 2.0	6.026560	0.793280	625	6.019457	0.589463	442
2.0 ≤ Δ < 3.0	6.050249	0.914556	201	6.121569	0.669440	153
0 < Δ < -0.5	5.725378	0.612098	13 811	5.672766	0.548988	9 088
0 < Δ < -1.0	5.448087	0.776684	732	5.439735	0.585716	453

Δ speed	All 6ax		SEMI	
	Mean in t	STD in t	Mean in t	STD in t
all	5.737110	0.641877	5.693562	0.567009
< 0.5	5.721460	0.628511	5.674378	0.558511
< 1.0	5.728826	0.631721	5.682559	0.561213
< 2.0	5.733511	0.636553	5.688057	0.563664
< 3.0	5.735400	0.637867	5.690663	0.565311
< - 0.5	5.431290	0.785355	5.427439	0.581275
< - 1.0	5.190196	0.873900	5.284615	0.512239

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Otta Sør E6 Oppland



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Akselavstand I

Tabell 1

Aksel/ akselkombinasjon	Akselavstand i meter	Tonn			
		Bk10	Bk7.5	Bk5	Bk4
Akselavstand (frakulende hjul)		10	8	8	6
Akselavstand (drivaksel)		11.5 <sup>1</sup>	8	8	6
Last fra to aksler	1.30 - 1.79 (trippelbogi)	18 <sup>1</sup>	14	12	9
	1.20 - 1.29 (trippelbogi)	16	12	12	9
	0.80 - 1.19	15	11.5	11.5	8.5
Under 0.80		10	8	8	6
Trippelbogi	1.20 - 1.29 <sup>2</sup>	24	19	16	12
	1.00 - 1.29 <sup>1</sup>	22	18	16	12
	Under 1.00 <sup>1</sup>	16	12	12	9



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Akselavstand III



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## 2 / 3-boggi per lastebil [ $C_v = 1.30$ ]

Stasjon	Kjoretøyer	Lastebiler	% Lastebiler	2-boggi	% 2-boggi	3-boggi	% 3-boggi
Storsand E39 [test]	53 127	5 479	10.3 %	3537	63.6 %	949	17.3 %
Storsand E39	1 436 097	130 221	9.0 %	83 581	64.2 %	21 637	16.6 %
Verdal E6							
Gjerdemyra E18	1 708 369	245 633	14.4 %	175 797	71.5 %	77 316	31.5 %
Otta Ser E6	1 430 387	213 861	14.9 %	157 813	73.8 %	54 166	25.3 %
Teigskamptunnelen E6 (A)	344 082	62 310	18.1 %	47 888	76.9 %	17 961	28.8 %
Teigskamptunnelen E6 (B)	338 531	60 218	17.8 %	46 724	77.6 %	17 431	28.9 %

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## Aksler per Lastebil

	Kjoretøyer	Aksler pr Kjoretøy
Gjerdemyra	1 708 376	2.4682
Storsand	2 026 876	2.2647
Verdal	2 792 707	2.2067
Otta	1 430 387	2.3155

- Data innsamlet fra ATK Storsandtunnel på E39
- Data innsamling Jan. 2016 – Des. 2016
- Truck = kjøretøy over 3,5 t

Stasjon	Lastebiler	Aksler	Aksler pr	Tidsrommet	% lunge	% Datamn	Cut off vekt
Storsand E39	130 975	497 908	3.80	12 måneder	10.4 %	12 %	3.5
Verdal E6	250 511	1 038 187	4.11	12 måneder	9.0 %	12.7 %	3.5
Gjerdemyra E18	237 902	1 076 614	4.52	11 måneder	13.9 %	18 %	3.5
Otta Ser E6	203 691	846 550	4.16		14.2 %	19.0 %	3.5

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## Average amount of Axles

(Storsandtunnel / Sør-Trøndelag E39)

- Data collected at ATK Storsandtunnel on E39
- Data collection Jan. 2016 – Dec. 2016
- Truck = vehicle over 3,5 t gross weight

Trucks	Axels	Axels per truck
130 975	497 908	3.8

	Number	Axel combination per Truck
Single Axle	308 889	2.3584
Boggiaxle	62 177	0.4747
Trippelaxle	21 555	0.1646

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