TRAVEL MODELING AND SPEED SENSITIVITY ANALYSES

In support of the air quality analysis conducted for the FEIS, a speed sensitivity analysis was performed.

Travel forecasts were prepared using the North I-25 EIS combined travel model for the year 2035. The North I-25 EIS combined model was developed from the NFRMPO travel model and DRCOG travel model, so that the North I-25 EIS study area could be covered by one inter-regional, multi-modal model. The North I-25 model reflects the adopted 2035 Regional Transportation Plans of each of the respective MPOs. It should be noted the combined model uses the DRCOG mode choice and traffic assignment procedures (trip generation and trip distribution are run separately for each MPO area) on a combined regional network. The standard DRCOG assignment procedures are used (100 iterations, convergence 0.01, 6 iterations of speed balancing).

The travel model produces forecasts of volume data for each link segment in the network. The links are categorized by facility type and area type. Additional information can be found in the *Travel Demand Traffic Technical Report (2010)*.

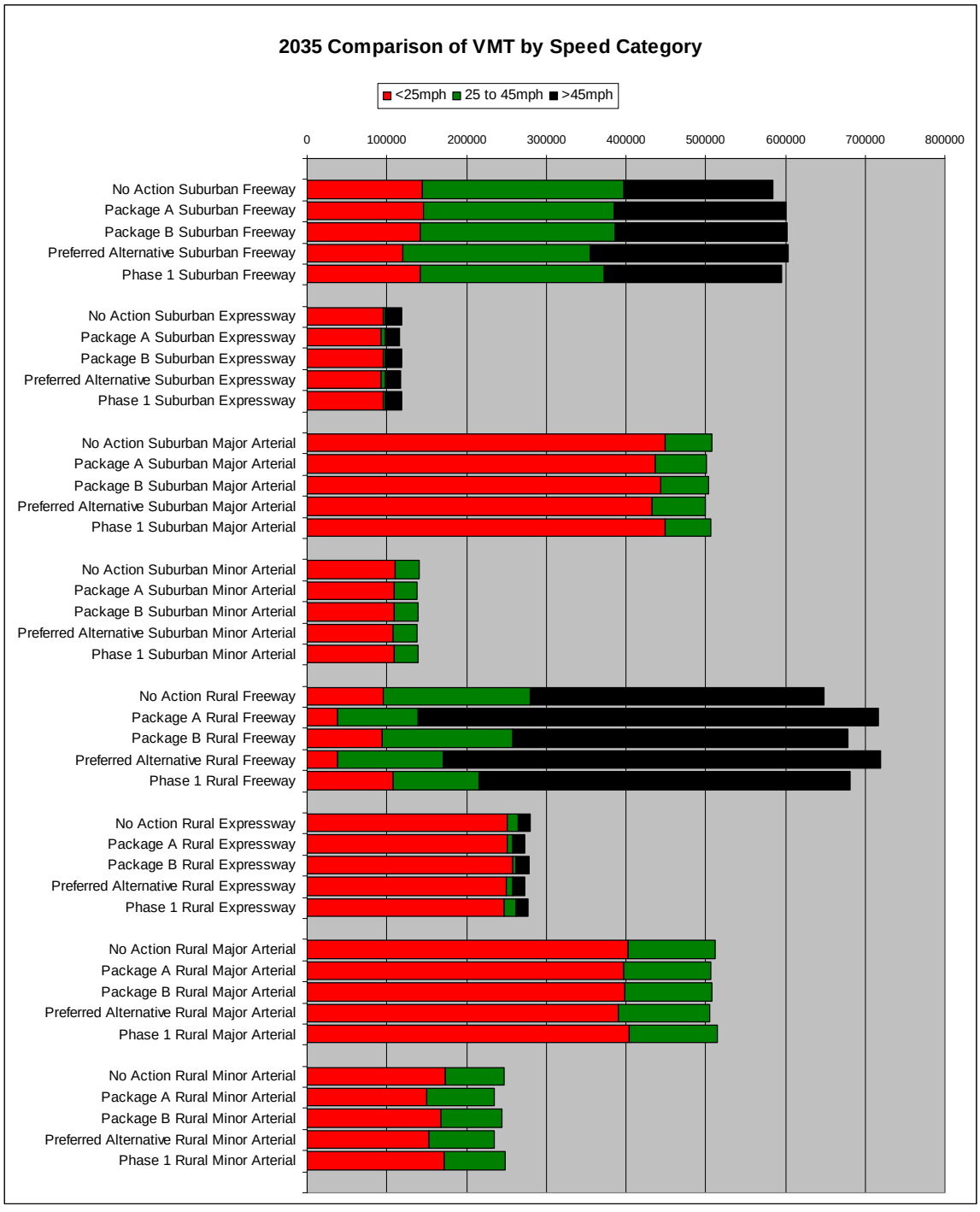
In the regional study area, the amount of VMT is about 30 million in 2005 and 53 million in 2035. This represents about a 57% growth in total VMT for the study area between years 2005 and 2035. Each SIP area has similar growth patterns. Among the alternatives, total VMT is slightly higher with the Preferred Alternative compared to all other alternatives (less than 1%). This is due to the increased highway system capacity, allowing for more mobility. About one third of the total VMT is on freeways. Another one third is on principal arterials, with the remainder on other facility types such as expressways, minor arterials, collectors and local roads. Package A and the Preferred Alternative draw slightly more (6%) traffic to the freeway than Package B or Phase 1, since the tolled express lanes of Package B and Phase 1 restrict access to some users.

The following analysis was performed to show a comparison of the 2035 VMT, speed category, and facility type for each Build Alternative. The analysis involved applying the speed curve to the link data, and tabulating the resulting VMT by three different speed categories for each of the facility type and area type combinations. The speed categories were based on the general points where emission rate curves "break" between higher rates and lower rates, as vehicle speed increases. In general emissions are higher less than 25 mph, and higher above 45 mph. Therefore, the VMT link data was divided for each facility and area type category into three speed classes:

- Less than 25mph (RED)
- 25 mph to 45 mph (GREEN)
- Greater than 45 mph (BLACK)

Figure 1 demonstrates that the alternatives show overall similar results. Closer examination reveals that the Package A and the Preferred Alternative have less VMT on the freeway in rural areas at speeds less than 25 mph, and at speeds between 25 to 45 mph, than do Package B and the No-Action alternatives. This is due to the freeway lane configurations of these alternatives compared to those of No-Action and Package B. Package A and the Preferred Alternative also have a greater amount of rural freeway VMT than No-Action and Package B; and in turn the VMT on expressways and arterials is slightly less and is at improved speeds in the study area. The speed categorization of other area types and road facility types show no notable differences among the alternatives and are not included in the **Figure 1**.

Figure 1. Comparison of 2035 VMT, Speed Category, and Facility Type for the Build Alternatives



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	<25mph	25 to 45mph	>45mph
No Action Suburban Freeway	145,315	251,912	187,717
Package A Suburban Freeway	146,239	239,187	214,893
Package B Suburban Freeway	142,286	243,411	215,961
Preferred Alternative Suburban Freew	119,744	235,627	248,565
Phase 1 Suburban Freeway	142,374	230,954	221,438
No Action Suburban Expressway	95,845	2,888	19,982
Package A Suburban Expressway	93,035	5,072	18,586
Package B Suburban Expressway	95,577	3,240	19,695
Preferred Alternative Suburban Expres	92,626	5,545	18,756
Phase 1 Suburban Expressway	95,704	2,915	19,808
No Action Suburban Major Arterial	449,173	58,970	-
Package A Suburban Major Arterial	437,017	64,062	-
Package B Suburban Major Arterial	443,127	60,711	-
Preferred Alternative Suburban Major	432,535	67,679	-
Phase 1 Suburban Major Arterial	449,747	56,276	-
No Action Suburban Minor Arterial	111,222	29,141	-
Package A Suburban Minor Arterial	109,529	28,994	-
Package B Suburban Minor Arterial	109,189	30,268	-
Preferred Alternative Suburban Minor	107,575	30,443	-
Phase 1 Suburban Minor Arterial	108,798	30,910	-
No Action Rural Freeway	96,231	184,159	368,423
Package A Rural Freeway	37,800	101,716	577,602
Package B Rural Freeway	94,839	163,141	421,108
Preferred Alternative Rural Freeway	37,727	132,730	548,318
Phase 1 Rural Freeway	107,266	108,730	465,299
No Action Rural Expressway	251,482	12,792	16,209
Package A Rural Expressway	250,940	6,745	14,802
Package B Rural Expressway	257,412	4,743	15,831
Preferred Alternative Rural Expresswa	249,686	8,658	14,839
Phase 1 Rural Expressway	247,655	13,866	15,645
No Action Rural Major Arterial	402,095	110,384	-
Package A Rural Major Arterial	396,834	109,406	-
Package B Rural Major Arterial	398,204	110,214	-
Preferred Alternative Rural Major Arte	390,551	114,034	-
Phase 1 Rural Major Arterial	404,753	109,533	-
No Action Rural Minor Arterial	172,797	74,970	-
Package A Rural Minor Arterial	150,846	83,769	-
Package B Rural Minor Arterial	167,269	77,471	-
Preferred Alternative Rural Minor Arte	152,572	81,720	-
Phase 1 Rural Minor Arterial	172,010	76,160	-

FEIS
Travel Data Preparation for Conformity Analysis

Travel Data: Direct output from the North I-25 Combined Regional Travel Demand Model. Link type, volume, and speed network link data is prepared by time period for each of the following alternatives:

- 2005,
- 2035 No-Action,
- 2035 Package A,
- 2035 Package B,
- 2035 Preferred Alternative,
- 2035 Phase I.

The link data is produced by the travel model for each time period: Three in the morning peak period, three in the afternoon peak period, and four off-peak periods for a total of ten periods to cover the 24-hour day.

File format: ARC GIS files, in file format per example sent by DRCOG

Note Regarding Managed Lane Volumes:
Wilber Smith and Associates is on the North I-25 consultant team to produce official traffic and revenue forecasts for managed lanes. This is because the North I-25 Combined Regional Travel Demand Model, developed by combining the regional models of NFRMPO and DRCOG, is not designed to estimate traffic in a HOV and tolled facility adequate to the level of detail needed in an EIS. WSA produces results for the morning peak hour, the afternoon peak hour, and an off-peak period for the remaining 22 hours.

The model results show that the WSA daily managed lane projections are higher than the forecasts produced by the North I-25 Combined Regional Travel Demand Model. Consideration was given to inserting the WSA managed lane volume projections into the link data files prepared for the air quality analysis, but no changes were made for the following reasons:

- A labor intensive process would be needed to manually enter the WSA data for each directional link, for each time period, for each model run. This process could be prone to data entry error. An automated process is not possible.
- There is minimal reference data available to convert the three periods of data provided by WSA to the ten periods of data needed for the format of the North I-25 Combined Regional Travel Demand Model.
- Comparison of the two projections shows that the peak hour estimates of WSA and the North I-25 Combined Regional Travel Demand Model are comparable, but the North I-25 Combined Regional Travel Demand Model has much lower volumes in the off-peak periods than WSA. Note the air quality benefit of the managed lanes is greatest during the peak, when the speed differential between the managed lanes and the general purpose lanes is greatest. However, only slight differences in air pollutant emissions would be realized since the managed lane volume projections are about the

same in the peak period. In the off-peak period, total emissions probably would not differ too much because there is only a small or inconsequential speed differential between the managed lanes and the general purpose lanes.

For these reasons, the original raw data from the North I-25 Combined Regional Travel Demand Model (without incorporation of the official managed lane volumes from WSA) is transmitted for conformity analysis.

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APCD Results

NAME	NAA POL	Pollutant (metric tons/day)	Base Year(200	No-Action Alt (203	Package A(2035	Package B(2035)	Preferred Alt (2(	Phase 1(2035)
TOTAL Region		Vehicle VMT (daily)	76,951,721	135,156,908	135,478,050	135,272,142	135,414,740	135,370,346
TOTAL Region		CO	1,831.548	1,608.643	1,613.490	1,608.513	1,613.089	1,609.990
TOTAL Region		VOC	105.737	46.842	47.121	47.041	47.050	47.127
TOTAL Region		NOX	164.989	38.291	38.707	38.537	38.699	38.593
TOTAL Region		PM-10	3.654	3.559	3.580	3.574	3.579	3.577
TOTAL Region		Acetaldehyde	0.766	0.354	0.361	0.360	0.361	0.361
TOTAL Region		Acrolein	0.062	0.030	0.031	0.031	0.031	0.031
TOTAL Region		Benzene	3.023	1.406	1.410	1.408	1.409	1.410
TOTAL Region		1,3 Butadiene	0.372	0.159	0.162	0.162	0.162	0.162
TOTAL Region		Diesel PM	1.441	0.103	0.109	0.108	0.109	0.108
TOTAL Region		Formaldehyde	1.317	0.645	0.663	0.662	0.662	0.663
Total for table			**2,112.909**	**1,700.033**	**1,705.635**	**1,700.397**	**1,705.151**	**1,702.023**
TOTAL Region		Ammonia	7.294	13.025	13.018	13.000	13.012	13.010
TOTAL Region		Diesel PM plus Organic Gases	5.572	3.227	3.403	3.392	3.395	3.399
8-hr O3 NAA	O3	Vehicle VMT (daily)	76,539,623	134,341,104	134,655,584	134,451,218	134,594,611	134,553,108
8-hr O3 NAA	O3	CO	1820.558	1596.287	1600.959	1596.004	1,600.590	1597.531
8-hr O3 NAA	O3	VOC	105.110	46.501	46.773	46.693	46.703	46.781
8-hr O3 NAA	O3	NOX	163.679	37.913	38.326	38.157	38.320	38.215
8-hr O3 NAA	O3	PM-10	3.626	3.537	3.558	3.552	3.556	3.554
8-hr O3 NAA	O3	Acetaldehyde	0.762	0.351	0.358	0.357	0.358	0.358
8-hr O3 NAA	O3	Acrolein	0.062	0.030	0.031	0.031	0.031	0.031
8-hr O3 NAA	O3	Benzene	3.006	1.394	1.398	1.396	1.397	1.399
8-hr O3 NAA	O3	1,3 Butadiene	0.370	0.158	0.161	0.161	0.161	0.161
8-hr O3 NAA	O3	Diesel PM	1.426	0.102	0.108	0.107	0.108	0.107
8-hr O3 NAA	O3	Formaldehyde	1.310	0.639	0.658	0.656	0.657	0.658
Total for table			**2099.910**	**1686.913**	**1692.331**	**1687.115**	**1691.880**	**1688.795**
8-hr O3 NAA	O3	Ammonia	7.256	12.949	12.941	12.923	12.935	12.934
8-hr O3 NAA	O3	Diesel PM plus Organic Gases	5.524	3.202	3.379	3.368	3.371	3.375
Denver Metro	CO	Vehicle VMT (daily)	62,004,903	106,396,435	106,376,899	106,315,567	106,279,595	106,290,868
Denver Metro	CO	CO	1,459.400	1,208.005	1,205.928	1,205.140	1,204.864	1,204.836
Denver Metro	CO	VOC	81.837	34.081	34.253	34.191	34.175	34.200
Denver Metro	CO	NOX	131.454	27.018	27.131	27.113	27.108	27.105
Denver Metro	CO	PM-10	2.892	2.808	2.815	2.814	2.813	2.813
Denver Metro	CO	Acetaldehyde	0.609	0.259	0.263	0.263	0.263	0.263
Denver Metro	CO	Acrolein	0.049	0.023	0.023	0.023	0.023	0.023
Denver Metro	CO	Benzene	2.387	0.990	0.991	0.990	0.989	0.990
Denver Metro	CO	1,3 Butadiene	0.296	0.113	0.116	0.115	0.115	0.115
Denver Metro	CO	Diesel PM	1.111	0.084	0.087	0.087	0.087	0.087
Denver Metro	CO	Formaldehyde	1.049	0.482	0.495	0.494	0.494	0.494
Total for table			**1,681.082**	**1,273.862**	**1,272.102**	**1,271.230**	**1,270.930**	**1,270.926**
Denver Metro	CO	Ammonia	5.877	10.242	10.215	10.209	10.205	10.207
Denver Metro	CO	Diesel PM plus Organic Gases	4.409	2.643	2.759	2.753	2.751	2.754
Denver Metro	O3	Vehicle VMT (daily)	64,319,797	110,171,887	110,090,058	110,068,097	109,985,427	110,044,051
Denver Metro	O3	CO	1,513.380	1,251.444	1,247.718	1,247.360	1,246.577	1,247.061
Denver Metro	O3	VOC	84.846	35.224	35.387	35.336	35.305	35.346
Denver Metro	O3	NOX	135.929	27.919	28.044	28.035	28.020	28.028
Denver Metro	O3	PM-10	2.997	2.905	2.913	2.913	2.910	2.912
Denver Metro	O3	Acetaldehyde	0.631	0.267	0.272	0.272	0.272	0.272
Denver Metro	O3	Acrolein	0.051	0.023	0.024	0.024	0.024	0.024
Denver Metro	O3	Benzene	2.474	1.024	1.024	1.023	1.023	1.024
Denver Metro	O3	1,3 Butadiene	0.307	0.117	0.120	0.119	0.119	0.119
Denver Metro	O3	Diesel PM	1.150	0.085	0.090	0.090	0.090	0.090
Denver Metro	O3	Formaldehyde	1.087	0.496	0.511	0.510	0.510	0.510
Total for table			**1,742.853**	**1,319.504**	**1,316.103**	**1,315.683**	**1,314.849**	**1,315.385**
Denver Metro	O3	Ammonia	6.096	10.612	10.572	10.570	10.562	10.568
Denver Metro	O3	Diesel PM plus Organic Gases	4.567	2.696	2.845	2.840	2.837	2.840
Denver Metro	PM10	Vehicle VMT (daily)	64,319,797	110,171,887	110,090,058	110,068,097	109,985,427	110,044,051
Denver Metro	PM10	CO	1,513.380	1,251.444	1,247.718	1,247.360	1,246.577	1,247.061
Denver Metro	PM10	VOC	84.846	35.224	35.387	35.336	35.305	35.346
Denver Metro	PM10	NOX	135.929	27.919	28.044	28.035	28.020	28.028
Denver Metro	PM10	PM-10	2.997	2.905	2.913	2.913	2.910	2.912
Denver Metro	PM10	Acetaldehyde	0.631	0.267	0.272	0.272	0.272	0.272
Denver Metro	PM10	Acrolein	0.051	0.023	0.024	0.024	0.024	0.024
Denver Metro	PM10	Benzene	2.474	1.024	1.024	1.023	1.023	1.024
Denver Metro	PM10	1,3 Butadiene	0.307	0.117	0.120	0.119	0.119	0.119
Denver Metro	PM10	Diesel PM	1.150	0.085	0.090	0.090	0.090	0.090
Denver Metro	PM10	Formaldehyde	1.087	0.496	0.511	0.510	0.510	0.510
Total for table			**1,742.853**	**1,319.504**	**1,316.103**	**1,315.683**	**1,314.849**	**1,315.385**
Denver Metro	PM10	Ammonia	6.096	10.612	10.572	10.570	10.562	10.568
Denver Metro	PM10	Diesel PM plus Organic Gases	4.567	2.696	2.845	2.840	2.837	2.840

Fort Collins	CO	Vehicle VMT (daily)	2,856,687	4,181,220	4,243,464	4,232,612	4,275,237	4,260,610
Fort Collins	CO	CO	70.616	59.857	61.026	60.679	61.505	61.177
Fort Collins	CO	VOC	5.077	2.030	2.056	2.052	2.066	2.062
Fort Collins	CO	NOX	5.509	1.736	1.773	1.761	1.788	1.777
Fort Collins	CO	PM-10	0.126	0.108	0.110	0.109	0.111	0.110
Fort Collins	CO	Acetaldehyde	0.032	0.015	0.015	0.015	0.015	0.015
Fort Collins	CO	Acrolein	0.003	0.001	0.001	0.001	0.001	0.001
Fort Collins	CO	Benzene	0.134	0.067	0.068	0.068	0.068	0.068
Fort Collins	CO	1,3 Butadiene	0.016	0.007	0.007	0.007	0.007	0.007
Fort Collins	CO	Diesel PM	0.044	0.002	0.002	0.002	0.002	0.002
Fort Collins	CO	Formaldehyde	0.053	0.024	0.025	0.025	0.025	0.025
Total for table			**81.609**	**63.847**	**65.083**	**64.719**	**65.589**	**65.245**
Fort Collins	CO	Ammonia	0.275	0.409	0.414	0.413	0.417	0.416
Fort Collins	CO	Diesel PM plus Organic Gases	0.181	0.077	0.080	0.079	0.080	0.080

Greeley	CO	Vehicle VMT (daily)	1,360,778	2,229,606	2,205,071	2,216,494	2,202,006	2,216,501
Greeley	CO	CO	33.684	31.728	31.430	31.598	31.394	31.598
Greeley	CO	VOC	2.385	1.072	1.059	1.064	1.057	1.064
Greeley	CO	NOX	2.539	0.912	0.901	0.906	0.900	0.906
Greeley	CO	PM-10	0.061	0.058	0.057	0.057	0.057	0.057
Greeley	CO	Acetaldehyde	0.015	0.008	0.008	0.008	0.008	0.008
Greeley	CO	Acrolein	0.001	0.001	0.001	0.001	0.001	0.001
Greeley	CO	Benzene	0.063	0.035	0.035	0.035	0.035	0.035
Greeley	CO	1,3 Butadiene	0.007	0.004	0.004	0.004	0.004	0.004
Greeley	CO	Diesel PM	0.022	0.001	0.001	0.001	0.001	0.001
Greeley	CO	Formaldehyde	0.025	0.013	0.013	0.013	0.013	0.013
Total for table			**38.802**	**33.832**	**33.508**	**33.686**	**33.469**	**33.687**
Greeley	CO	Ammonia	0.130	0.217	0.215	0.216	0.215	0.216
Greeley	CO	Diesel PM plus Organic Gases	0.085	0.040	0.037	0.038	0.037	0.038

Longmont	CO	Vehicle VMT (daily)	1,228,313	1,986,785	1,932,519	1,969,994	1,927,143	1,966,115
Longmont	CO	CO	28.725	22.801	22.029	22.430	21.969	22.386
Longmont	CO	VOC	1.635	0.615	0.601	0.612	0.599	0.611
Longmont	CO	NOX	2.188	0.480	0.474	0.483	0.473	0.482
Longmont	CO	PM-10	0.051	0.051	0.050	0.051	0.050	0.051
Longmont	CO	Acetaldehyde	0.012	0.004	0.004	0.004	0.004	0.004
Longmont	CO	Acrolein	0.001	0.000	0.000	0.000	0.000	0.000
Longmont	CO	Benzene	0.048	0.019	0.018	0.018	0.018	0.018
Longmont	CO	1,3 Butadiene	0.006	0.002	0.002	0.002	0.002	0.002
Longmont	CO	Diesel PM	0.016	0.001	0.001	0.001	0.001	0.001
Longmont	CO	Formaldehyde	0.020	0.007	0.008	0.008	0.008	0.008
Total for table			**32.702**	**23.981**	**23.188**	**23.611**	**23.125**	**23.564**
Longmont	CO	Ammonia	0.118	0.195	0.188	0.192	0.188	0.192
Longmont	CO	Diesel PM plus Organic Gases	0.066	0.028	0.033	0.034	0.033	0.034