RSG INC.
RESOURCE SYSTEMS GROUP, INC.

MEMORANDUM

To: Tom Kennedy, Southern Windsor County Regional Planning Commission
From: Joe Segale, P.E.
Subject: Ski Corridor Travel Time Model – Traffic Impact Test (Draft for Review)
Date: 1 April 2004

INTRODUCTION

The purpose of this memorandum is to test the ability of the Ski Corridor Travel Time Model to evaluate the impact of a development project. The test is conducted by comparing estimated travel time along VT 103 from the Okemo Ridge Road in Ludlow to the VT 11 intersection in Chester with and without traffic from the proposed Jackson Gore Phase II project at Okemo Mountain Resort. The travel time estimates were developed using the Ski Corridor Travel Time Model and data available in the traffic impact study completed for Jackson Gore Phase II[1]. Travel time estimates are provided for the following scenarios that were analyzed in the traffic impact study:

- 2005 Winter Design Hour Volume (DHV) with background growth and traffic from Jackson Gore Phase I;
- 2005 Winter DHV with background growth and traffic from Jackson Gore Phases I and II;
- 2010 Winter DHV with background growth and traffic from Jackson Gore Phase I;
- 2010 Winter DHV with background growth and traffic from Jackson Gore Phases I and II;
- 2005 Summer peak with background growth and traffic from Jackson Gore Phase I;
- 2005 Summer peak hour with background growth and traffic from Jackson Gore Phases I and II;
- 2010 Summer peak hour with background growth and traffic from Jackson Gore Phase I; and
- 2010 Summer peak hour with background growth and traffic from Jackson Gore Phases I and II.

The Winter DHV occurs during Sundays between 4:00 and 5:00 PM. The Summer Peak Hour is assumed to occur during an August Sunday between noon and 1:00 PM. Refer to the traffic impact study for a detailed explanation of how traffic volumes were developed.

[1] "Okemo Mountain Resort Jackson Gore Phase II Traffic Impact Analysis"; Bruno Associates; Woodstock, VT; December 16, 2003.

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The Ski Corridor Travel Time Model is spreadsheet based. It estimates travel time along a corridor by adding the delay encountered at intersections to the travel time along the connecting road segments. Travel through intersections and road segments are both affected by traffic volumes and highway/intersection operational and physical characteristics. The delay encountered at intersections is estimated outside of the spreadsheet model using software based on the *2000 Highway Capacity Manual*. For this analysis, the intersection delays were taken directly from in the *Jackson Gore Phase II Traffic Impact Analysis*[1] The estimated intersection delays were manually entered into the spreadsheet where they are automatically added to road segment travel times to develop the total corridor travel time. The road segment travel times are estimated within the Ski Corridor Travel Time Model spreadsheet using formulas developed from *Planning Techniques to Estimate Speeds and Service Volumes for Planning Applications, NCHRP 387*[2]. Road segment traffic volumes are based on intersection turning movement volumes which were taken directly from the *Jackson Gore Phase II Traffic Impact Analysis*[3].

The corridor consists of the VT 103 intersections with:

- Okemo Ridge Road;
- VT 100;
- Okemo Mountain Road;
- Depot Street;
- VT 131;
- VT 10[4]; and
- VT 11.

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[1] Delays for Winter DHV are provided in the table on Page 11. Delays for the summer peak are provided in the table on page 13.

[2] Detailed information on the Ski Corridor Travel Time Model is contained in the *Ski Corridor Traffic Management Study – April 2001* and *Ski Corridor Traffic Management Study Phase 2A Model Testing and Calibration Technical Memorandum – March 31, 2003*, both by Wilbur Smith Associates.

[3] Figures 1 through 11

[4] RSG developed the traffic volume and delay estimates at the VT 10 intersection because it was not included in the *Jackson Gore Phase II Traffic Impact Study*. The traffic volumes at the VT 10 intersection are based upon a count conducted on Sunday, February 18 2001. This count was adjusted to 2005 and 2010 winter design hour volume and the summer peak hour, for the build and no-build scenarios, using the same methodology and trip generation estimates summarized in the *Jackson Gore Phase II Traffic Impact Study*.

RESULTS

Table 1 and Table 2 show the effect of traffic from Jackson Gore Phase II on total travel time in the corridor. The travel time estimates presented for the Winter DHV in Table 1 assume no changes to the existing lane configurations and that traffic control officers are present at the intersections of VT 103 with VT 100, Okemo Mountain Road, and VT 11. The existing lane configuration is also assumed at the VT 103/Depot Street intersection which may be control by either the existing traffic signal or a traffic control officer. The tables also show the effect of mitigation measures as recommended in the *Jackson Gore Phase II Traffic Impact Study*. For the 2010 winter DHV scenario, the mitigation assumes that 50 southbound vehicles will be eliminated. As a result, the increase in corridor travel time associated with Jackson Gore Phase II is reduced from 11% to 1%. The mitigation proposed for the summer peak is to provide a traffic control officer at the VT 11 intersection. This mitigation measure reduces the projected change in corridor travel time from 7%^ to 4% in 2005 and 12% to 3% in 2010.

Table 3 through Table 6 provide the travel time estimates for each segment of the study corridor under all scenarios with and without mitigation. The segment by segment comparison can help target locations where mitigation should be focused. For example, the travel time between VT 10 and VT 11 is projected to increase by 26% during the 2010 Summer peak (Table 6). By focusing the mitigation at this choke point, the overall corridor travel time is improved as well.. The segment by segment comparison also shows the corridor-wide benefits of reducing overall trip generation. Table 4 shows the impact of reducing trip generation by 50 vehicles per hour in 2010 during the Winter DHV. This mitigation approach eliminates the 67% increase in travel time between Okemo Mountain Resort and Depot Street and reduces delays throughout the corridor.

OBSERVATIONS

Using corridor travel time provides a useful tool in understanding the broader impacts of traffic from a development. Specific intersection LOS analyses will continue to be necessary to identify where vehicle delays and queues are critical and possibly unacceptable. The corridor-wide travel time estimate can supplement the standard one-intersection-at-a-time analysis by:

- Putting individual intersection delays into context. Delay at one intersection may be large. However, the delay may not be significant when considered as part of a longer trip;
- Helping to identify critical locations in the corridor where mitigation measures should be focused; and
- Showing the system-wide effects of specific mitigation measures.

Table 1. Estimated Travel Time (minutes) on VT 103 between Okemo Ridge Road and VT 11 - Winter DHV (Sunday PM Peak)

Year	Background Growth with Jackson Gore Phase I	*No Mitigation*			*Mitigate 50 Southbound Trips at Depot St.*		
		Background Growth with Jackson Gore Phases I and II	Absolute Difference	Percent Difference	Background Growth with Jackson Gore Phases I and II	Absolute Difference	Percent Difference
2005	26.40	27.45	1.05	4%	No Mitigation Recemmended		
2010	27.83	30.93	3.11	11%	28.20	0.38	1%

Table 2. Estimated Travel Time (minutes) on VT 103 between Okemo Ridge Road and VT 11 –August Mid-day

Year	Background Growth with Jackson Gore Phase I	*No Mitigation*			*With Traffic Control Officer at VT 103/VT 11*		
		Background Growth with Jackson Gore Phases 1 and II	Absolute Difference	Percent Difference	Background Growth with Jackson Gore Phases I and II	Absolute Difference	Percent Difference
2005	19.57	20.92	1.35	7%	20.34	0.77	4%
2010	19.94	22.37	2.43	12%	20.59	0.64	3%

Table 3. 2005 Winter DHV Travel Time Comparison by Segment

Segment		***Travel Time (Minutes)***			
From	To	Background Growth with Jackson Gore Phase I	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference
VT 103 Eastbound Thru Okemo Ridge Rd Intersection		0.13	0.13	0.00	0%
Okemo Ridge Road	VT 100	0.65	0.67	0.02	3%
VT 100	Okemo Mountain Road	2.17	2.28	0.11	5%
Okemo Mountain Road	Depot Street	2.76	2.99	0.23	8%
Depot Street	VT 131	8.04	8.68	0.64	8%
VT 131	VT 100	5.88	5.88	0.00	0%
VT 100	VT 11	6.76	6.81	0.05	1%
	Total	26.40	27.45	1.05	4%

Table 4. 2010 Winter DHV Travel Time Comparison by Segment

Segment		***Travel Time (Minutes)***						
			No Mitigation			***Mitigate of 50 Southbound Trips at Depot St.***		
From	To	Background Growth with Jackson Gore Phase I	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference
VT 103 Eastbound Thru Okemo Ridge Rd Intersection		0.13	0.13	0.00	0%	0.13	0.00	0%
Okemo Ridge Road	VT 100	0.66	0.69	0.03	5%	0.69	0.03	4%
VT 100	Okemo Mountain Road	2.50	2.32	-0.18	-7%	2.28	-0.22	-9%
Okemo Mountain Road	Depot Street	2.93	4.91	1.97	67%	3.31	0.37	13%
Depot Street	VT 131	8.77	9.63	0.86	10%	8.86	0.10	1%
VT 131	VT 100	5.91	6.04	0.13	2%	5.91	0.00	0%
VT 100	VT 11	6.92	7.22	0.29	4%	7.02	0.10	1%
	Total	27.83	30.93	3.11	11%	28.20	0.38	1%

Table 5. 2005 August Sunday Mid-day Travel Time Comparison by Segment

Segment		***Travel Time (Minutes)***						
			No Mitigation			***With Traffic Control Officer at VT 103/VT 11***		
From	To	Background Growth with Jackson Gore Phase I	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference
VT 103 Eastbound Thru Okemo Ridge Rd Intersection		0.13	0.13	0.00	1%	0.13	0.00	1%
Okemo Ridge Road	VT 100	0.43	0.44	0.00	1%	0.44	0.00	1%
VT 100	Okemo Mountain Road	1.66	1.70	0.04	2%	1.70	0.04	2%
Okemo Mountain Road	Depot Street	1.13	1.26	0.13	12%	1.26	0.13	12%
Depot Street	VT 131	4.57	5.07	0.50	11%	5.07	0.50	11%
VT 131	VT 100	5.42	5.51	0.09	2%	5.51	0.09	2%
VT 100	VT 11	6.23	6.82	0.59	9%	6.23	0.00	0%
	Total	19.57	20.92	1.35	7%	20.34	0.77	4%

Table 6. 2010 August Sunday Mid-day Travel Time Comparison by Segment

Segment		***Travel Time (Minutes)***						
			No Mitigation			***With Traffic Control Officer at VT 103/VT 11***		
From	To	Background Growth with Jackson Gore Phase I	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference	Background Growth with Jackson Gore Phase I and Phase II	Absolute Difference	Percent Difference
VT 103 Eastbound Thru Okemo Ridge Rd Intersection		0.13	0.13	0.00	0%	0.13	0.00	0%
Okemo Ridge Road	VT 100	0.43	0.44	0.00	1%	0.44	0.00	1%
VT 100	Okemo Mountain Road	1.67	1.71	0.04	3%	1.71	0.04	3%
Okemo Mountain Road	Depot Street	1.16	1.30	0.14	12%	1.30	0.14	12%
Depot Street	VT 131	4.68	5.16	0.48	10%	5.16	0.48	10%
VT 131	VT 100	5.44	5.55	0.11	2%	5.55	0.11	2%
VT 100	VT 11	6.43	8.09	1.65	26%	6.30	-0.13	-2%
	Total	19.94	22.37	2.43	12%	20.59	0.64	3%

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