

**Statement of John Niles, Technical Chair
Coalition for Effective Transportation Alternatives (CETA)
to High Capacity Transit (HCT) Expert Review Panel (ERP)
October 21, 2005**

CETA thanks ERP for emphasizing clearly that the mode choice and performance of Sound Transit Phase 2 (ST2) high capacity transit (HCT) depends on the design and performance of Sound Transit Phase 1 HCT in the north-south I-5 corridor. This is especially true for the HCT crossing of Lake Washington.

Because of the interdependency, CETA recommends that you on ERP should be asking and insisting to State of Washington that your mission, scope, and resources be expanded as necessary to allow your examination of North Link Light Rail. While Sound Transit insists that this is an already-decided part of future light rail construction, everybody knows that this un-expert-review-panel-examined part of Sound Move Phase 1 requires funding beyond the 1996 Sound Move tax rate authorization. North Link funding authorization must and will be included in the ST2 tax vote.

Under the RCW 81.104 law posted on the ERP website, your panel in this era is clearly obliged to review North Link as thoroughly and completely as ST2, including the reasonableness of the North Link plan assumptions, the sufficiency of the analysis, and the suitability of the alternatives considered. You need to re chew the cud, to recycle Mr. Kiepper's memorable phrase.

As the North Link briefing on October 20th made clear, even the first part of the northward extension, the 3.3 mile light rail train tunnel under Capitol Hill to U of W Husky Stadium – with a capital cost alleged to be \$1.5 billion plus financing cost and contingencies – is several years away from being ready to go into construction with its \$700 million New Starts grant. There is time left for ERP to help Sound Transit and the citizens of Washington State to get this part of HCT right.

Even a cursory examination of Sound Transit's finances indicates that not a shovel of dirt can be turned on the North Link extension of Initial Segment until a successful ST2 tax increase election is held in the taxing district. Prior to that vote, a pending Supreme Court decision on the impact of the statewide I-776 \$30 tabs initiative law on Sound Transit's Motor Vehicle Excise Tax (MVET) will likely be issued, which may affect North Link's fiscal viability.

As the RCW and legislative history makes clear, the very reason for the ERP's existence is to examine the big, expensive HCT systems plans that are going to be presented to voters in the future.

Way back in January 2001 on the first day of the Bush administration, the CBD-to-University portion of North Link light rail was claimed by Sound Transit to be at 30%

design, had a completed EIS, a fully-funded financing plan, a Federal Record of Decision (ROD), and a fully-executed Full Funding Grant Agreement for \$500 million. North Link was also proceeding under the protection of a frequently cited Expert Review Panel report that asserted that Sound Move Phase 1 was good to go, that its costs and ridership were well estimated, even conservative.

But because of intervention from many quarters, that early FFGA was abandoned by Sound Transit just a few months later in June 2001. In 2002, the ROD for Link Light Rail to Northgate was replaced by a new ROD covering only the Initial Segment running south of downtown Seattle. The EIS process was restarted for North Link, and is still underway.

In Summer 2001, the Link Project Review Committee headed by former Seattle Mayor Charles Royer and including prominent civic leaders Senator Slade Gorton, Governor Booth Gardner, and civic visionary Jim Ellis, and staffed by John Howell of Cedar River Group, recommended that the Capitol Hill Tunnel be abandoned. However, the Sound Transit Board decided again, a few years later, that the Capitol Hill Tunnel must be built.

Yet, as the First Hill Tunnel Station elimination indicates, Link North is a whole new ball game – it has changed in alignment, number of stations, budget, and timeline. What the first Expert Review Panel said back in the last century is now irrelevant. And political leaders and voters need again to be advised by outside experts, according to State law.

Note that North Link if approved and built would be the most expensive light rail in world history. This Seattle subway would change the definition of what light rail means by narrowing the distinction between light rail and heavy rail. North Link's SEIS of November 2003 reveals that the dirt to be moved from behind the Tunnel Boring Machine would fill our Qwest Field football stadium to the height of two Space Needles. The energy consumed by moving all that dirt in over one hundred thousand dump truck runs on the streets of Seattle will not be repaid before 80 years have passed, if ever.

Both FTA guidelines and Sound Transit's enabling legislation intend for light rail to be compared with the best, most cost-effective alternatives. A former King County Metro Transit Director has published an alternative transit plan that matches and exceeds Link Light Rail ridership for far less cost. Sound Transit's no build alternative in the analysis of light rail is far less clear, because clarity of alternatives is not important to Sound Transit at this point. The Sound Transit Long Range Plan says light rail must be built, despite the requirement of meaningful alternatives analysis.

If indeed Sound Transit's planning assumptions and alternatives analysis for the Seattle Subway to Husky Stadium and Northgate are reasonable – and we at CETA understand that they are not reasonable – voters who want to be fully informed need you on the ERP to make that finding. By law ERP must be ordered to examine North Link.

[Note, a version of this message will be sent to the Governor, the Secretary of Transportation, and key members of the State Legislature.]

Questions? Contact John Niles, CETA Technical Chair at 206-781-4475, or jniles@alum.mit.edu

Dirt Removal and Energy Input to Construct North Link Light Rail

Draft by John Niles, CETA, March 20, 2005

As the time draws closer for the voters of the region to decide whether or not to increase Sound Transit's taxing rate to build Link North from downtown Seattle to Northgate, a close examination of construction impacts is warranted. One argument against light rail is the environmental cost of constructing it. Bus rapid transit would require far less construction activity than light rail. Since North Link is mostly to be built underground, one might mistakenly think that the construction would be invisible and only lightly impacting the environment. This is not so.

The North Link Environmental Impact Statement (EIS), page 4-175, notes that the construction of underground facilities "will generate large volumes of spoils." Dirt – sand, gravel, silt, and clay – needs to be removed from the underground right of way of the light rail line. The tunnel for North Link from the Pine Street stub tunnel to the point of emergence south of Northgate is over five miles long.

How large a volume of tunnel spoils will be generated?

The EIS reports in Table 4.17-13 that the preferred alternative (options A1.1 and B1.D combined) would generate between 1.82 and 2.50 million cubic yards of spoils, including dirt from underground stations, crossovers, and vent shafts using tunnel boring, mining, and cut & cover techniques. At 15 cubic yards per truck, moving this dirt requires in the range of 121,000 to 167,000 truck trips¹ over the complete period of construction.

In perspective, two million cubic yards of dirt formed in a block with sheer vertical walls on top of the playing area of a football field² would rise to about 1,125 feet,³ which is 520 feet higher than the Space Needle. The location where these truckloads of dirt would be hauled is not clear in the EIS, although Sound Transit expects that some of the spoils could be sold as fill dirt.

How many dump truck loads per day will be needed to carry this much dirt?

The EIS reports on page 4-148 that 500 to 750 cubic yards of spoils per day would be generated by the tunnel-boring machine. This large machine is expensive, and would run seven days per week. It is like a large snake that augurs along underground, discharging dirt behind it. There is likely to be only one tunnel-boring machine in operation. Over seven days, 3,500 to 5,250 cubic yards⁴ of dirt would be generated by tunnel boring, in other words, 233 to 350 truckloads⁵ per week.

Assume for a moment that the dump trucks hauling away tunnel dirt are to load up and be dispatched from a single tunnel spoils removal point during mid-day only in order to stay out of peak period. Assume the trucks would move only on weekdays, to avoid disturbing the peace of Seattle citizens on nights and weekends. This plan would mean that for 30 hours per week –

¹ 1,820 thousand cubic yards, or 2,500 thousand cubic yards, divided by 15 cubic yards per truck

² 300 feet long by 160 feet wide

³ 160 feet times 300 feet times 1125 feet divided by 27 cubic feet in a yard

⁴ 7 days multiplied by 500, or 750, cubic yards per day

⁵ 3,500 cubic yards, or 5,250 cubic yards, per week divided by 15 cubic yards per truck

Monday to Friday, 9am to 3pm – the stream of traffic generated would be one dump truck every five⁶ to eight⁷ minutes.

How many years would this stream of dump trucks be operating if spoils are generated at 500 to 750 cubic yards per day?

Combining the total estimated volume of tunnel spoils with the weekly volume of 233 to 350 trucks generated by tunnel digging, we find the elapsed length of time for the spoils removal to be 347⁸ to 714⁹ weeks from a single excavation point. This many weeks directly translates to a dirt-moving period ranging from 6.7 to 13.7 years.

However, the EIS contemplates a construction period for North Link in the range of only 4 to 7 years, so there must be an assumption that spoils can be generated faster than the rate reported for a single tunnel-boring machine.

So, let's assume for the sake of discussion that tunnel spoils are generated at *twice* the rate of that claimed for a single tunnel-boring machine, via other digging machines and techniques operating simultaneously. In this case, a stream of trucks totaling 466 to 700 vehicles per week moving during weekday off-peak hours every five to eight minutes in parallel from each of *two* spoils removal sites could move the necessary dirt in half the time calculated above, that is, 3.3 to 6.9 years. This range is in line with Sound Transit's construction estimate.

How much energy is consumed digging the North Link tunnel and removing all that dirt?

As reported in Section 4.17.10 of the EIS, the fuel to dig the tunnel and remove between one hundred and two hundred thousand loads of dirt, plus all other North Link construction activity, yields an energy cost of 17,439 billion BTU. This is equivalent to 15,750 tanker trucks full of diesel fuel, 8,000 gallons each. This amount of energy is termed “relatively low given the regional energy consumption.” By comparison, all of the motor vehicle traffic in the central Puget Sound region consumes about 471 billion BTU in a day, according to EIS Table 4.9-1. In other words, the energy to construct North Link over four to seven years is equivalent to the energy consumed in just 37 days of regional motor vehicle operation. Unfortunately, North Link's planned passenger loads will eliminate very little of this motor vehicle energy.

How much energy is consumed building North Link compared to the energy saved when it is in operation?

Page 4-91 of the EIS reports that North Link in operation will save 0.55 billion BTU per day in 2030. This takes into account the energy savings from citizens leaving their cars at home and riding light rail instead. These savings mean that the pay back time on the regional energy debt created by light rail construction will be about 87 years¹⁰, a very poor return on investment, indeed, given the uncertainty inherent in almost nine decades of technological depreciation and innovation. This pay back estimate is likely to prove way too optimistic given that energy-consuming reconstruction of North Link will certainly be required before that many decades passes.

⁶ 30 hours times 60 minutes per hour divided by 350 trucks is 5.14 minutes per truck.

⁷ 30 hours times 60 minutes per hour divided by 233 trucks is 7.73 minutes per truck.

⁸ 1.82 million cubic yards divided by 5,250 cubic yards per week

⁹ 2.50 million cubic yards divided by 3,500 cubic yards per week

¹⁰ 17,439 divided by 0.55 per day divided by 365 days per year yields 86.9 years.

CENTRAL LINK EXTENDED TO AIRPORT AND TO UW STADIUM

Prepared by James W. MacIsaac, P.E. August 17, 2005

2005 Baseline v1 Nominal \$1000s	NORTH KING LINK w/CPS to UW STADIUM					SOUTH KING LINK w/AIRPORT EXTENSION*					TOTAL CENTRAL LINK w/EXTENSIONS				
	Cumulative Totals thru: (Length - 12.7 miles)					Cumulative Totals thru: (Length - 6.2 miles)					Cumulative Totals thru: (Length - 18.9 miles)				
	2009	2020	2030	2040	2050	2009	2020	2030	2040	2050	2009	2020	2030	2040	2050
Sources of Funds															
Taxes	952,477	2,339,248	4,380,724	7,380,160	12,359,790	335,507	882,378	1,815,529	3,014,121	5,004,009	1,287,983	3,221,625	6,196,253	10,394,281	17,363,799
Federal Grants - Link IS	362,765	490,420	653,893	829,153	1,004,413	153,314	204,352	275,496	356,388	437,280	516,079	694,772	929,389	1,185,541	1,441,693
Grants & Bud Shifts - Extensions	150,000	676,255	757,992	845,622	933,252	51,000	76,072	111,022	150,760	190,498	201,000	752,327	869,013	996,381	1,123,749
Bonds - Link IS	689,926	689,926	689,926	689,926	689,926	277,980	277,980	277,980	277,980	277,980	967,906	967,906	967,906	967,906	967,906
Bonds - Extensions	0	759,300	759,300	759,300	759,300	148,000	148,000	148,000	148,000	148,000	148,000	907,300	907,300	907,300	907,300
Fares & other - Link IS	2,359	123,228	308,222	616,259	1,127,660	352	19,901	51,943	86,236	143,168	2,711	143,130	360,165	702,495	1,270,828
Fares & other - Extensions	0	51,700	236,694	544,731	1,056,132	Insignificant increase in Riders					0	51,700	236,694	544,731	1,056,132
Other Sources	(4,369)	9,683	9,683	9,683	9,683	None for Link IS					(4,369)	9,683	9,683	9,683	9,683
Regional Fund Contributions	(84,506)	(159,668)	(261,093)	(429,019)	(707,808)	Already Deducted from Tax Revenue					(84,506)	(159,668)	(261,093)	(429,019)	(707,808)
Interest	63,674	78,301	93,451	116,051	153,573	Already Allocated to Regional Fund					63,674	78,301	93,451	116,051	153,573
Total Sources	2,132,325	5,058,393	7,628,790	11,361,867	17,385,921	966,153	1,608,684	2,679,971	4,033,485	6,200,934	3,098,478	6,667,077	10,308,761	15,395,351	23,586,855
Net of Fare Revenues	2,129,966	4,883,464	7,083,874	10,200,876	15,202,129	965,801	1,588,782	2,628,027	3,947,249	6,057,767	3,095,767	6,472,247	9,711,902	14,148,124	21,259,895
Uses of Funds															
Link IS - Capital	1,732,015	1,752,370	1,752,370	1,752,370	1,752,370	655,998	663,795	663,795	663,795	663,795	2,388,013	2,416,165	2,416,165	2,416,165	2,416,165
O&M and Admin	37,787	419,143	1,005,400	1,981,591	3,602,253	13,909	194,197	471,352	782,533	1,299,152	51,695	613,340	1,476,751	2,764,124	4,901,404
Link Extensions - Capital	150,000	1,500,000	1,500,000	1,500,000	1,500,000	225,000	225,000	225,000	225,000	225,000	375,000	1,725,000	1,725,000	1,725,000	1,725,000
O&M and Admin	1,500	136,135	570,887	1,294,804	2,496,643	2,250	70,604	175,683	291,668	484,223	3,750	206,739	746,571	1,586,472	2,980,867
Debt Service - Link IS @ 5.00%	127,898	624,742	1,133,202	1,442,898	1,442,898	51,039	250,512	454,849	579,829	579,829	178,937	875,254	1,588,051	2,022,726	2,022,726
Debt Service - Link Extensions	0	281,705	818,140	1,356,882	1,555,663	6,350	107,466	212,476	303,224	303,224	6,350	389,171	1,030,616	1,660,106	1,858,887
Reserves - Link IS	64,167	260,042	460,642	671,981	883,320	34,135	105,521	178,319	254,788	331,258	98,302	365,563	638,961	926,770	1,214,578
Reserves - Extensions	0	89,312	179,732	284,732	389,732	0	26,968	54,470	83,358	112,246	0	116,280	234,202	368,090	501,979
Total Uses	2,113,367	5,063,450	7,420,374	10,285,259	13,622,879	988,681	1,644,063	2,435,944	3,184,194	3,998,727	3,102,048	6,707,513	9,856,318	13,469,453	17,621,605
Net of Fare Revenues	2,111,008	4,888,521	6,875,458	9,124,268	11,439,087	988,329	1,624,161	2,435,944	3,097,959	3,855,559	3,099,337	6,512,683	9,259,459	12,222,226	15,294,646
Ending unrestricted cash	18,958	(5,057)	208,416	1,076,608	3,763,042	(22,528)	(35,379)	244,027	849,290	2,202,208	(3,570)	(40,436)	452,443	1,925,898	5,965,249
Unused Bond Capacity @1.15	235,590	281	418,894			(148,919)	246,689	494,951			86,671	246,970	913,845		