DIVISION 900 – MISCELLANEOUS

SECTION 901 – WEBSITES AND CONTACT INFORMATION

901.1 – TRANSPORATATION INFORMATION WEBSITES

Transportation Information Websites	
Organization	Website
American Association of State Highway Transportation Officials (AASHTO)	www.transportation.org
Associated General Contractors (AGC) of New Hampshire	http://www.agcnh.org/MemberListing/
U.S. Environmental Protection Agency, 2012 Construction General Permit (CGP)	http://ofmpub.epa.gov/apex/aps/f?p=CGP_2012:Home:11731235208828
Federal Highway Administration (FHWA), Office of Safety	http://safety.fhwa.dot.gov
Material Safety Data Sheets (MSDS) Solutions Center	www.msds.com
Federal Highway Administration Manual of Uniform Traffic Control Devices (MUTCD)	http://mutcd.fhwa.dot.gov
New Hampshire Department of Transportation (NHDOT)	http://www.nh.gov/dot/index.htm
NHDOT Interdepartmental Phone List	http://www.nh.gov/dot/contactus/index.htm
U.S. Department of Labor, Occupational Safety & Health Administration (OSHA)	www.osha.gov
Pile Dynamics, Inc. (PDI), Pile Driving Equipment and Measurement Information	http://www.pile.com/pdi/
NHDOT Project Development Research Center, Qualified Products	http://www.nh.gov/dot/org/projectdevelopment/materials/research/products.htm
NHDOT Engineers/Consultants, Weighted Average Unit Prices	http://www.nh.gov/dot/business/engineers.htm

901.2 – NHDOT PERSONNEL AND EMPLOYEE SERVICES

NHDOT Personnel and Employee Services – Contact Information (1)			
BUREAU	PHONE	FAX	CELL
Administrative Services	3496		
Aeronautics	2551		
Anthem BCBS– Customer Service	800–933–		
Anthem Life – Customer Service	800–227–		
Archives	2236	2272	
Associated General Contractors of NH	225–2701	226–3859	
NH Attorney General's Office	3675	2110	
Bridge Design	2731	2759	
Bridge Maintenance	3667/3668	1588	
Principal Engineer (Doug Gosling)			419–9695
Operations Engineer (Steve Johnson)			419–9694
Maintenance & Construction Engineer (Tim Boodey)			419–9690
Maintenance & Construction Engineer (Andrew Hall)			419–0498
Crew #1 – Lancaster (Joseph Ingerson)	788–2301		419–0524
Crew #2 – Twin Mountain (Mark Fagnant)			419–9506
Crew #3 – New Hampton (William Fullerton)			419–0479
Crew #4 – Sunapee (Christopher Moen)			419–0480
Crew #5 – Allenstown (Reed Deinhardt)			396–4645
Crew #6 – Newfields (Paul Spinney)			396–4215
Crew #7 – Antrim (Doug Haskins)	588–3365		419–0481
Crew #8 – Ossipee (Robert Libby)			396–6557
Crew #10 – Rumney (William Smith)			419–0482
Crew #11 – Epping (Eric Browser)			396–4216
Crew #13 & 13B – Franklin (Normand Legere)			419–0483

NHDOT Personnel and Employee Services – Contact Information (2)			
BUREAU	PHONE	FAX	CELL
Franklin Yard	934–5735	934–3333	
Bailey Yard	934–5429	934–3333	
Crew #14 – Bedford (Richard Thoroughgood)	669–0662		419–0484
Crew #15 – Portsmouth (Gene Popien)	436–1099, 431–4132	436–3701	396–4644
Memorial Bridge [Portsmouth]	300–6751	Emergency Backup	436–2432
Sarah Mildred Long Bridge [Portsmouth]	419–9693	Emergency Backup	436–3830
Hampton Draw Bridge [Hampton]*	926–3348		
Rye–New Castle Bridge [Little Harbor]*	433–4654		
Interstate Bridge Authority [Portsmouth]	433–1562		
* Hampton Draw Bridge and Rye–New Castle Bridge are operated by District 6			

NHDOT Personnel and Employee Services – Contact Information (3)			
BUREAU	PHONE	FAX	CELL
Commissioner / Director Office	1484	3914	
Construction	2571	3461	
Value Flex	800–649–8452		
Jim Bowles	1587		419–9531
Shaun Flynn	1586		419–0129
Steve Glines	7052		419–9524
Nickie Hunter	1585		419–9340
Paul Metcalf	1544		419–9345
Dean Wilson	2573		419–9342
Contracts	3732	1558	
Prequalification (Deb Weil)	3402		
Deferred Compensation	581–9225		
Delta Dental – Customer Service	800–832–5700		
D.E.S.	3503	6588	
Engineering Audit	1556	2349	
Dennis Herrick	3463	2349	
Shawn Murphy	1608	2349	
Jim Downs	6122	2349	
EPM (Flex Spending)	888–269–2744		
Environment	3226	7199	
Federal Credit Union	7731	224–1042	
F.H.W.A.	228–0417	228–2829	
Finance & Contracts	3466	2653	
Fuel Distribution	2056	6085	

NHDOT Personnel and Employee Services – Contact Information (4)			
BUREAU	PHONE	FAX	CELL
GHRS Problems	3747		
Help Desk	7555		
Highway Design	2171	7025	
Consultant Design	1591	7025	
Preliminary Design	1596	7025	
Final Design	3525	7025	
Conference Room	2296		
Survey	3192	7025	
Highway Maintenance*	2693	6084	
Maintenance Engineer (Caleb Dobbins)			
Assistant Maintenance Engineer (Mark Kirouac)			
Permit Section / Lane Restrictions	2691	6084	
DISTRICT ONE – Lancaster	788–4641	788–4260	
DISTRICT TWO – Enfield	448–2654	448–2059	
DISTRICT THREE – Gilford	524–6667	524–8027	
DISTRICT FOUR – Swanzey	352–2302	352–7725	
DISTRICT FIVE – Hooksett	666–3336	666–3337	
DISTRICT SIX – Durham	868–1133	868–5397	
DISTRICT SIX – Basement (Construction)	868–6490		
* See separate table for Patrol Shed contact information			

NHDOT Personnel and Employee Services – Contact Information (5)			
BUREAU	PHONE	FAX	CELL
Human Resources	3734	8817	
Benefits (Lorraine Felladore)	6611	8817	
Training (Jen Graf)	8025	8817	
Payroll	3492	8817	
Postings	2545	8817	
Classifications	8027	8817	
Information Technology Services (ITS)	3281	0385	
Labor Compliance			
Jay Ankenbrock	2467		
Dave Cloutier	6612		
Doug Potter	6752		419–9391
Lobby / Receptionist	3734	8817	
Materials & Research	3151	8700	
Chemistry Lab	7932		
Concrete & Soils	1656		
Concrete & Soils Lab (Test results)	1661		
Geology (blasting)	1657		
Geotechnical	1654		
Materials	1545		

NHDOT Personnel and Employee Services – Contact Information (6)			
BUREAU	PHONE	FAX	CELL
Research (Qualified Products List)	1659		
Ride Quality (Van, Retroreflectivity)	7655		
Mechanical Services (pool car requests)	3721	1649	
GARAGES:			
Concord (Murry Howlett)	3611	1649	
Center Ossipee	539–4583		
Enfield	448–4015		
Lancaster	788–4177		
North Hampton	964–6500		
Swanzey	352–9102		
Twin Mountain	846–5741		
Municipal Highways	2107	6382	
OSHA	225–1629	225–1580	
Traffic	2291	6083	
Sign Shop	2300	6083	
Sign Supervisor, D–1 (Russell Bell)			419–0357
Sign Supervisor, D–2 (Donald Kibbee)			419–0359
Sign Supervisor, D–3 (Douglas Hinton)			419–0378
Sign Supervisor, D–4 (Mark Vaillancourt)			419–0378
Sign Supervisor, D–5 (James Edmunds)			419–0385
Sign Supervisor, D–6 (Jamie Cotnoir)			410–0384

NHDOT Personnel and Employee Services – Contact Information (7)			
BUREAU	PHONE	FAX	CELL
Signal Shop	2294	6083	
Signal Repairman, Area 1 (Robert Foster)			419–0395
Signal Repairman, Area 2 (William Taylor)			801–1346
Signal Repairman, Area 3 (Dave Kirby)			419–0396
Transportation Planning	3344	8093	
Twin Mountain	846–5572	846–5047	
Utilities	3652		
White Farm (Concord)	3241		
Turnpikes*	485–3806	485–2107	
* See separate table for Patrol Shed contact information			

901.3 – HIGHWAY MAITENANCE DISTRICTS

Highway Maintenance – District One				
Lancaster (Phone: 788–4641, Fax: 788–4260)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Columbia	237–4904		Pittsburg	538–6610
Crawford Notch	278–5572		West Milan	449–6675
Dixville	255–3911		Whitefield	837–9106
Errol	482–3249			
Franconia	823–5516		REST AREAS	PHONE
Franconia–Butterhill	823–5338		Colebrook	237–5390
Glen	383–9447		Littleton	444–0125
Gorham	466–2272		Shelburne	466–2607
Groveton	636–2000			
Jefferson	586–4329		GARAGES	PHONE
Lancaster	788–4411		Twin Mountain	846–5741
Lincoln	745–8933		Lancaster	788–4177
Lisbon	838–6062			
Littleton	444–5086		MISCELLANEOUS	PHONE
Milan	449–3332		Lancaster Sign Shop	788–2427
Monroe	638–4767		Twin Mountain Office	846–5572
Pinkham Notch	466–3832			

Highway Maintenance – District Two				
Enfield (Phone: 448–2654, Fax: 448–2059)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Andover	735–5196		Orford	353–4530
Bristol	744–3050		Rumney	786–9935
Canaan	523–4541		Sunapee	863–1140
Cornish	675–2450		Wentworth	764–5568
Enfield	448–1057			
Franklin	934–5221		REST AREA	PHONE
Lebanon	448–1349		Springfield	763–9684
Lempster	863–1577			
New London	526–6409		WEIGH STATION	PHONE
Newbury (Closed)	938–5340		Springfield	448–2697
North Haverhill	787–6332			

Highway Maintenance – District Three				
Gilford (Phone: 524–6667, Fax: 524–6669)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Alton	875–2050		Tamworth	323–7788
Ashland	968–3342		Thornton	726–8983
Belmont	267–6501		Tilton	267–7920
Conway	447–5783		Tuftonboro	544–8391
Freedom	539–4551		Wakefield	522–3621
Loudon	783–4219			
Meredith	279–6943		REST AREAS	PHONE
Moultonboro	476–5777		Conway	356–3961
New Hampton	744–8059		Sanbornton	264–4650
Ossipee (Closed)	539–6852			

Highway Maintenance – District Four				
Swanzey (Phone: 352–2302, Fax: 352–7725)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Alstead	756–3607		Marlow	446–3362
Charlestown	826–5555		Nelson/Stoddard	847–3419
Chesterfield	363–4400		Rindge	899–5537
Greenfield	547–3302		Swanzey	352–6614
Greenville	878–2318		Temple	924–6956
Hancock	525–3705		Troy	242–6622
Hillsborough	478–3328		Walpole	445–5380
Hinsdale/Winchester	336–5321		Westmoreland	399–4307
Marlborough	876–3984			

Highway Maintenance – District Five				
Hooksett (Phone: 485–9526, Fax: 485–9825)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Allenstown	485–5050		Hollis	465–2567
Bedford	669–5419		Hooksett	624–1441
Bow	224–0793		Londonderry	432–5976
Candia	483–8811		Londonderry	434–3103
Canterbury	783–4326		Manchester	622–1651
Chester	895–3100		Milford	673–3550
Chichester	798–5652		Raymond (Closed)	895–3100
Derry	432–7921		Salem	898–9086
Goffstown	497–2471		Warner (Closed)	456–2240
Henniker	428–7785		Warner	746–4223

Highway Maintenance – District Six				
Durham (Phone: 868–1133, Fax: 868–5397)				
PATROL SHEDS	PHONE		PATROL SHEDS	PHONE
Dover	742–3948		Newfields	778–8876
Epping	679–5314		North Hampton	964–8886
Exeter	773–9937		North Hampton/Rye	964–6796
Gonic	332–7034		Northwood	942–5971
Kingston	642–3401		South Kingston (CLOSED)	382–8014
Lee	868–5726		Strafford	664–9344
Milton	652–4521			

901.4 – TURNPIKE MAITENANCE

Turnpike Maintenance	
Headquarters (Phone: 485–3806, Fax: 485–2107)	
PATROL SHEDS	PHONE
Dover	742–2887
Hampton	926–6862
Hooksett	485–3783
Merrimack	424–9249
Nashua	577–9141

901.5 – TOLL PLAZAS

Toll Plazas	
LOCATION	PHONE
Bedford	647–2988
Dover	742–6804
Hampton	926–2560
Hampton Ramp	926–0438
Hooksett	485–9352
Merrimack – Exit 10	889–2818
Merrimack – Exit 11	424–6829
Rochester	332–2087

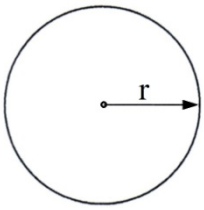
901.6 – INFORMATION CENTERS

Information Centers	
LOCATION	PHONE
Hooksett "S"	485–3542
Nashua	882–0023
Seabrook	474–5211

SECTION 902 – GEOMETRIC AND TRIGONOMETRIC CALCULATIONS

902.1 – AREA, CIRCUMFERENCE, AND VOLUME FORMULAS

A. Circle



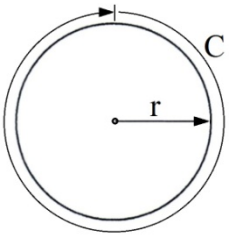
Area

where $\pi = 3.14159\ldots$, d = circle diameter, and r = circle radius,

$A = \pi d^2 / 4$

and

$A = \pi r^2$.



Circumference

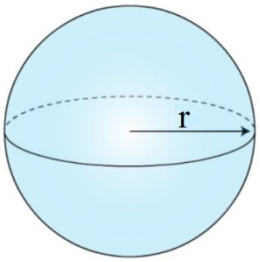
where $\pi = 3.14159\ldots$, d = circle diameter, and r = circle radius,

$C = \pi d$

and

$C = 2 \pi r$.

B. Sphere



Volume

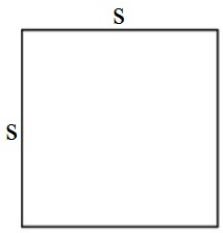
where π = 3.14159…, d = sphere diameter, and r = sphere radius,

V = π d3 / 6

and

V = 4 / 3 π r3.

C. Square

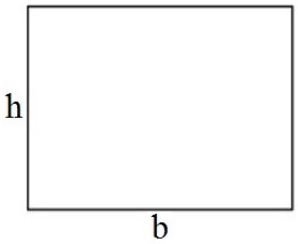


Area

where s = length of each side,

$A = s^2$.

D. Rectangle

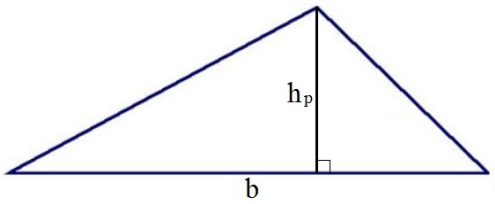


Area

where b = base and h = height,

A = b × h.

E. Triangle

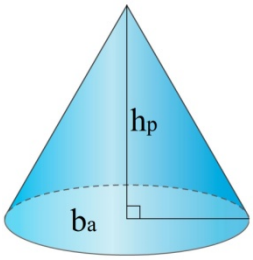


Area

where b = base and h_p = perpendicular height,

$A = ½\ b \times h_p$.

F. Cone



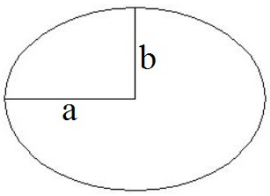
Volume

where b_a = base area* and h_p = perpendicular height,

$V = ⅓\ b_a \times h_p$.

* Refer to calculating the area of a circle

G. Ellipse

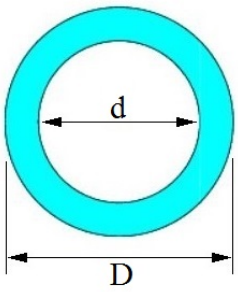


Area

where π = 3.14159…, a = semi–major axis, and b = semi–minor axis,

$A = \pi\ a\ b$.

H. Annulus (Circular Ring)

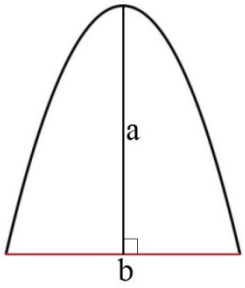


Area

where $\pi = 3.14159\ldots$, D = outside ring diameter, and d = inside ring diameter,

$A = \pi / 4 (D^2 - d^2)$.

I. Parabolic Curve

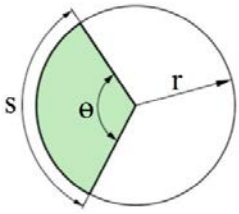


Area

where a = height and b = chord,

$A = 2 / 3\ a\ b$.

J. Sector of a Circle



Area

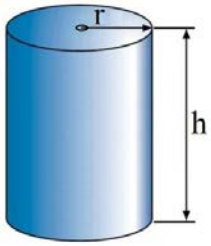
where Θ = sector center angle, r = circle radius, and s = minor sector arc length,

$s = r\ \Theta$,

then,

$A = ½\ r\ s$.

K. Cylinder



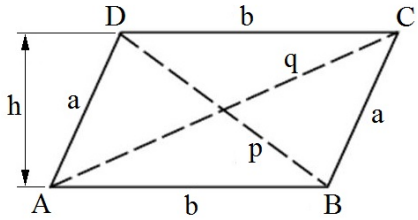
Volume

where $\pi = 3.14159\ldots$, r = cylinder radius, and h = cylinder height,

$V = \pi r^2 h$.

L. Parallelogram

A parallelogram is quadrilateral with opposite sides parallel (and therefore opposite angles equal). A quadrilateral with equal sides is called a rhombus, and a parallelogram whose angles are all right angles is called a rectangle. The polygon diagonals of a parallelogram bisect each other.



Area

where a = side a, b = side b, h = height, A, B, C, and D = angles, and p and q = diagonals,

$A = b \times h$,

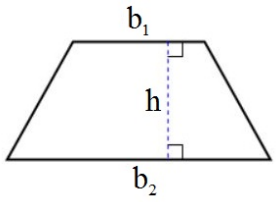
and,

$A = a\ b\ \mathit{sin}\ A$,

and,

$A = a\ b\ \mathit{sin}\ B$.

M. Trapezoid



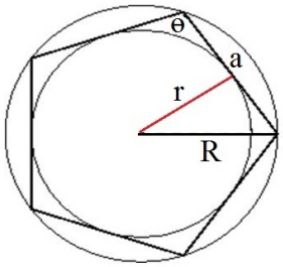
Area

where b_1 = side 1, b_2 = side 2, and h = height,

$A = \frac{1}{2} h (a + b)$.

N. Regular Polygon

A regular polygon has sides that are all the same length, and angles that are all the same. The sum of the angles of a polygon with *n* sides, where *n* is 3 or more, is 180° (*n* – 2). For an *n*–sided regular polygon of side *a*, ϴ is the angle at any vertex.



Area

where n = number of sides, a = length of a side, r = apothem (radius of inscribed circle), and R = radius of circumscribed circle,

and

p = n × a = polygon perimeter,

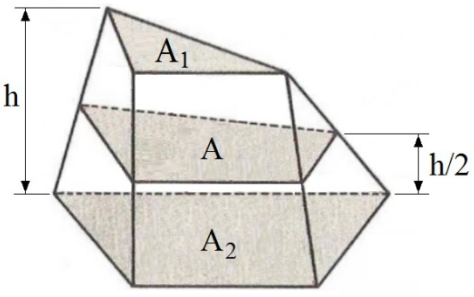
$A = \frac{1}{2} r p$.

The following table has regular polygon formulas for determining the area, apothem, and circumscribed radius for three– to twelve–sided polygons:

Regular Polygon Formulas				
Name	k	Area	r	R
Equilateral triangle	3	0.43301 a^2	0.28868 a	0.57735 a
Square	4	a^2	0.5 a	0.70711 a
Regular pentagon	5	1.72048 a^2	0.68819 a	0.85065 a
Regular hexagon	6	2.59808 a^2	0.86603 a	a
Regular heptagon	7	3.63391 a^2	1.03826 a	1.15238 a
Regular octagon	8	4.82843 a^2	1.20711 a	1.30656 a
Regular nonagon	9	6.18182 a^2	1.37374 a	1.46190 a
Regular decagon	10	7.69421 a^2	1.53884 a	1.61803 a
Regular undecagon	11	9.36564 a^2	1.70284 a	1.77473 a
Regular dodecagon	12	11.19625 a^2	1.86603 a	1.93185 a

O. Prismatoid

A prismatoid is a polyhedron where all vertices lie in two parallel planes. Its lateral faces can be trapezoids or triangles. If both planes have the same number of vertices, and the lateral faces are either parallelograms or trapezoids, it is called a prismoid.

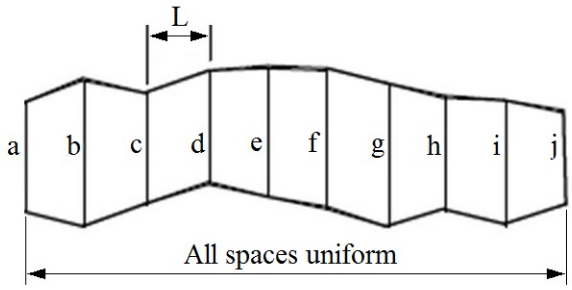


Volume

where h = height of prismatoid, A = cross–sectional area at h/2, A_1 = area of prismatoid top, A_2 = area of prismatoid base,

$V = h / 6 (A_1 + 4A + A_2)$.

P. Irregular Figure



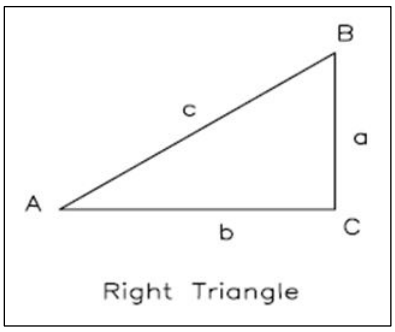
Area

where L = uniform length of each side, and a through j = depth of each irregular area,

A = L (((a + j) / 2) + b + c + d + e + f +g + h+ i).

902.2 – TRIGONOMETRIC FUNCTIONS

A. Right Triangles

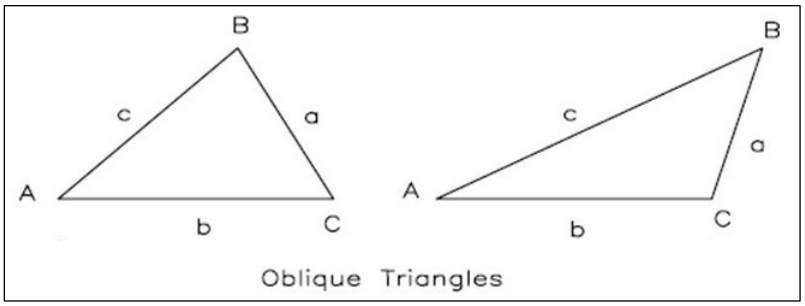


Trigonometric solutions for right triangles:

For angle A: $\sin A = a/c$; $\cos A = b/c$; $\tan A = a/b$; $\cot A = b/a$;
$\sec A = c/b$; $\operatorname{cosec} A = c/a$

Given	Required	
a, b	A, B, c	$\tan A = a/b = \cot B$; $c = \sqrt{a^2+b^2} = a\sqrt{1+b^2/a^2}$
a, c	A, B, b	$\sin A = a/c = \cos B$; $b = \sqrt{(c+a)(c-a)} = c\sqrt{1-a^2/c^2}$
A, a	B, b, c	$B = 90° - A$; $b = a \cot A$; $c = a/\sin A$
A, b	B, a, c	$B = 90° - A$; $a = b \tan A$; $c = b/\cos A$
A, c	B, a, b	$B = 90° - A$; $a = c \sin A$; $b = c \cos A$

B. Oblique Triangles



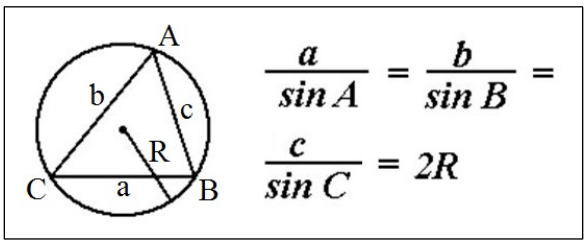
Oblique Triangles

Trigonometric solutions for oblique triangles:

Given	Required	
A, B, a	b, c, C	$b = (a \sin B)/\sin A$; $C = 180° - (A + B)$; $c = (a \sin C)/\sin A$
A, a, b	B, c, C	$\sin B = (b \sin A)/a$; $C = 180° - (A + B)$; $c = (a \sin C)/\sin A$
a, b, C	A, B, c	$A + B = 180° - C$; $\tan (A - B)/2 = [(a - b)/(a + b)][\tan (A + B)/2]$ $c = (a \sin C)/\sin A$
a, b, c	A, B, C	$s = (a + b + c)/2$; $\sin (A/2) = \sqrt{[(s-b)(s-c)]/bc}$; $\sin (B/2) = \sqrt{[(s-a)(s-c)]ac}$; $C = 180° - (A + B)$
a, b, c	Area	$s = (a + b + c)/2$; $\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{Area} = (bc \sin A)/2$
A, B, C, a	Area	$\text{Area} = (a^2 \sin B \sin C)/(2 \sin A)$

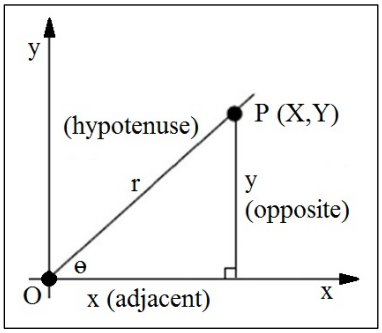
Source: *http://www.ncees.org/exams/study_materials/land_surveying_equations.pdf*

C. Law of Sines



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

D. Basic Trigonometric Functions



The following table lists the basic trigonometric functions:

Sine	$\sin\theta = \frac{y}{r} = \frac{\text{opposite}}{\text{hypotenuse}}$
Cosine	$\cos\theta = \frac{x}{r} = \frac{\text{adjacent}}{\text{hypotenuse}}$
Tangent	$\tan\theta = \frac{y}{x} = \frac{\text{opposite}}{\text{adjacent}}$
Cotangent	$\cot\theta = \frac{x}{y} = \frac{\text{adjacent}}{\text{opposite}}$
Secant	$\sec\theta = \frac{r}{x} = \frac{\text{hypotenuse}}{\text{adjacent}}$
Cosecant	$\csc\theta = \frac{r}{y} = \frac{\text{hypotenuse}}{\text{opposite}}$
Reciprocal Relations	$\sin\theta = \frac{1}{\csc}$ $\tan\theta = \frac{1}{\cot\theta}$ $\cos\theta = \frac{1}{\sec}$
Rectangular	$X = r \cdot \cos\theta$ $y = r \cdot \sin\theta$
Polar	$r = \sqrt{(x^2 + y^2)}$ $\theta = \arctan\frac{y}{x}$

Source: WSDOT Highway Engineering Field Formulas, 1998, Engineering Publications, WA

E. Slope Conversions

The following slope conversion table show slope percentages and equivalent inches per foot of slope:

Slope Conversion Table					
Percent Slope	Inches per foot		Inches per 10 ft	Inches per 15 ft	Inches per 20 ft
	Actual decimal	Approx. fraction			
0.10%	0.012	1/64	1/8	3/16	1/4
0.13%	0.015	1/64	5/32	7/32	5/16
0.20%	0.024	1/32	1/4	3/8	15/32
0.26%	0.031	1/32	5/16	15/32	5/8
0.30%	0.036	3/64	3/8	17/32	23/32
0.40%	0.048	3/64	1/2	23/32	31/32
0.50%	0.060	1/16	19/32	29/32	1 3/16
0.52%	0.062	1/16	5/8	15/16	1 1/4
0.60%	0.072	5/64	23/32	1 3/32	1 7/16
0.78%	0.093	3/32	15/16	1 13/32	1 7/8
0.80%	0.096	3/32	31/32	1 7/16	1 29/32
1.00%	0.120	1/8	1 3/16	1 13/16	2 13/32
2.00%	0.180	3/16	1 13/16	2 11/16	3 19/32
2.50%	0.240	1/4	2 7/16	3 5/8	4 13/16
3.00%	0.360	3/8	3 5/8	5 7/16	7 3/16
4.00%	0.480	1/2	4 13/16	7 1/4	9 19/32

Source: NHDOT Construction Manual, 1983 insert

The following table shows shoulder slopes with equivalent rates of grade and vertical angles:

Shoulder Slope	Equivalent Rate of Grade	Equivalent Vertical Angle
1:1.5	66.67%	33°41'24"
1:1.75	57.14%	29°44'42"
1:2	50.00%	26°33'54"
1:2.5	40.00%	21°48'05"
1:3	33.33%	18°26'06"
1:4	25.00%	14°02'10"
1:5	20.00%	11°18'36"
1:6	16.67%	9°27'44"
1:8	12.50%	7°07'30"
1:10	10.00%	5°42'38"

The following table shows subgrade slopes with equivalent rates of grade and vertical angles:

Subgrade Slope	Equivalent Rate of Grade	Equivalent Vertical Angle
.020 / 1	2.00%	1°08'45"
.025 / 1	2.50%	1°25'56"
.030 / 1	3.00%	1°43'06"
.035 / 1	3.50%	2°00'16"
.040 / 1	4.00%	2°17'26"
.050 / 1	5.00%	2°51'45"

Source: WSDOT Highway Engineering Field Formulas, 1998, Engineering Publications, WA

902.3 – CONVERSIONS – GENERAL

General Conversion Table (1)		
MULTIPLY	BY	TO OBTAIN
Acres	43,560	Square feet
Acres	0.001562	Square miles
Barrels of Cement	376	Pounds of cement
Bags of Cement (1 ft^3)	94	Pounds of cement
B.T.U.	778.26	ft–lbs
Cubic feet	7.48052	U.S. Gallons
Cubic feet	1,728	Cubic inches
Cubic feet of water	62.37	Pounds of water
Cubic feet of water	28.29	Kilograms of water
Cubic inches	0.004329	U.S. gallons
Cubic yards	27	Cubic feet
Cubic yards	46.656	Cubic inches
Cubic yards	202	U.S. gallons
° Celsius = 5/9 (° F – 32)		
° Fahrenheit = 9/5 ° C + 32		
Fathoms	6	Feet
U.S. gallons	231	Cubic inches
U.S. gallons	3.785	Liters
Gallons of water	8.34	Pounds of water
Gallons of water	3.785	Kilograms of water
Hectare	10,000	Square meters

General Conversion Table (2)		
MULTIPLY	BY	TO OBTAIN
Horsepower	550	ft–lbs / sec.
Horsepower	33000	ft–lbs / min.
Horsepower	2544	B.T.U.'s / hr
Horsepower	745.5	Watts
Miles	5,280	Feet
Pounds	16	Ounces
Pounds of Water	0.01602	Cubic feet
Pounds of Water	27.68	Cubic inches
Pounds of Water	0.1198	U.S. Gallons
Rod	16.5	Feet
Speed of Light	186,000	Miles/second
Speed of light	300,000	Km/s
Square feet	144	Square inches
Square miles	640	Acres
Square yards	9	Square feet
Square yards	0.0002066	Acres
Tons (short)	2,000	Pounds
Tons (long)	2,240	Pounds

902.4 – CONVERSIONS – METRIC

English Units to Metric Units Conversion Table (1)				
Symbol	To convert from	Multiply by	To determine	Symbol
LENGTH				
in	inch	25.4	Millimeters	mm
ft	feet	0.3048	Meters	m
yd	yards	0.9144	Meters	m
mi	miles	1.609344	Kilometers	km
AREA				
in^2	Square inches	645.16	Square millimeters	mm^2
ft^2	Square feet	0.09290304	Square meters	m^2
yd^2	Square yards	0.83612736	Square meters	m^2
ac	Acres	0.4046873*	Hectares (= 10 000 m2)	ha
mi^2	Square miles	2.59	Square kilometers	km^2
VOLUME				
in^3	Cubic inches	16.387064	Cubic centimeters	cm^3
ft^3	Cubic feet	0.0283168	Cubic meters	m^3
yd^3	Cubic yards	0.764555	Cubic meters	m^3
gal	Gallons	3.78541	Liters	L
oz	Fluid ounces	0.0295735	Liters	L
MBM	Thousand board feet	2.35974	Cubic meters	m^3
MASS				
lb	Pounds	0.4535924	Kilograms	kg
ton	Short tons (2000 lbs)	0.9071848	Metric tons (= 1000 kg)	t
*Based on U.S. Survey Foot				
Note: To convert from Metric units to English units, divide by the conversion factor				

English Units to Metric Units Conversion Table (2)				
Symbol	To convert from	Multiply by	To determine	Symbol
		PRESSURE AND STRESS		
t/ft^2	Tons per square foot	95.7606	Kilopascals	kPa
lbs/ft^2	Pounds per square foot	47.8803	Pascals	Pa
lbs/in^2	Pounds per square	6.89476	Kilopascals	kPa
lbs/in^2	Pounds per square	0.00689476	Megapascals	MPa
		DISCHARGE		
ft^3/sec	Cubic feet per second	0.02831	Cubic meters per second	m^3/s
		VELOCITY		
ft/sec	Feet per second	0.3048	Meters per second	m/s
		INTENSITY		
In/hr	Inch per hour	25.4	Millimeters per hour	mm/hr
		FORCE		
lb	Pound (force)	4.448222	Newtons	N
		POWER		
hp	Horsepower	746.0	Watts	W
		TEMPERATURE		
°F	Degrees Fahrenheit	5 X (°F – 32)/9	Degrees Celsius	°C
		DENSITY		
lbs/ft^3	Pounds per cubic foot	16.01846	Kilograms per cubic meter	kg/m^3
		ACCELERATION		
G	Freefall, standard (ft/sec^2)	9.807	Meters per second squared	m/s^2
Note: To convert from Metric units to English units, divide by the conversion factor				

Source: NHDOT Metric Conversion Guide – May 1998

SECTION 903 – FIELD LAYOUT AND MEASUREMENT

903.1 –ONE–PERSON METHOD FOR MEASURING DRIVES, APPROACHES, AND DITCHES

A. General Procedure

The following steps outline the one–person method for measuring drives, approaches, and ditches:

1. Stretch string from O.G. at A to O.G. at B.
1. Fasten the zero mark on the tape at point A.
2. Measure the horizontal distance from A to the break in slope (d1 on the tape).
3. Measure the vertical distance from the string to break in slope (c1) using a rule.
4. Measure c2 at d2, c3 at d3, and so forth.
5. Compute the area as follows:

$$\left(\frac{0+c_1}{2}\right)\times(d_1) + \left(\frac{c_1+c_2}{2}\right)\times(d_2) + \left(\frac{c_2+c_3}{2}\right)\times(d_3) + \ldots$$

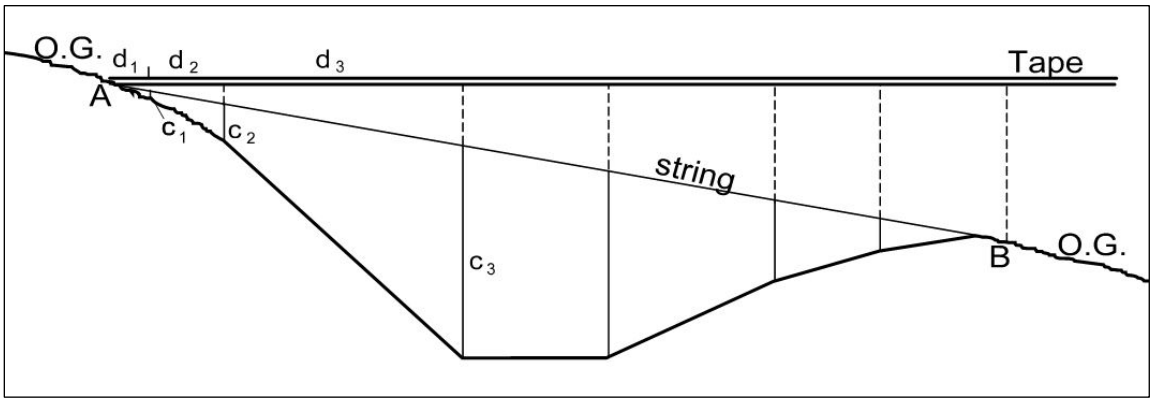


Figure 900 – 1: One Person Method for Measuring Drives, Approaches, and Ditches

B. Steel Tape Temperature Corrections

$C = 6.45 \times 10^{-6} (T - 68) L$

where,

C = Correction factor

T = Temperature (°F)

L = Length (ft)

C. Determining Radii of Sharp Curves by Field Measurements

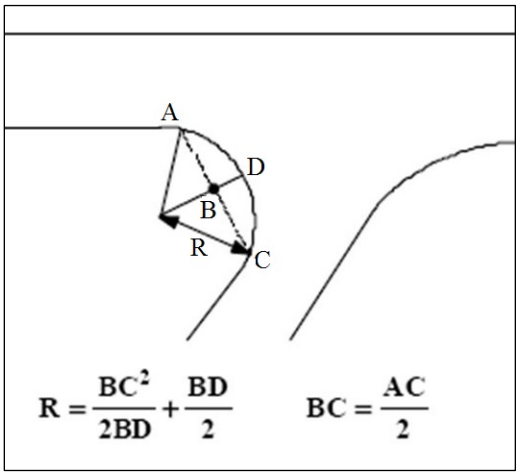


Figure 900 – 2: Radii Calculations for Sharp Curves

Note: Points A and C may be any two points on the curve

Example

1. Measure the chord length from A to C:

AC = 18.4 ft and BC = 9.2 ft

2. Measure the middle ordinate B to D:

BD = 3.5 ft

3. Compute the radius:

$R = 9.2^2 / 7.0 + 3.5 / 2 = 13.8$ ft

903.2 – ROADWAY AND DITCH EXCAVATION PAY LIMITS

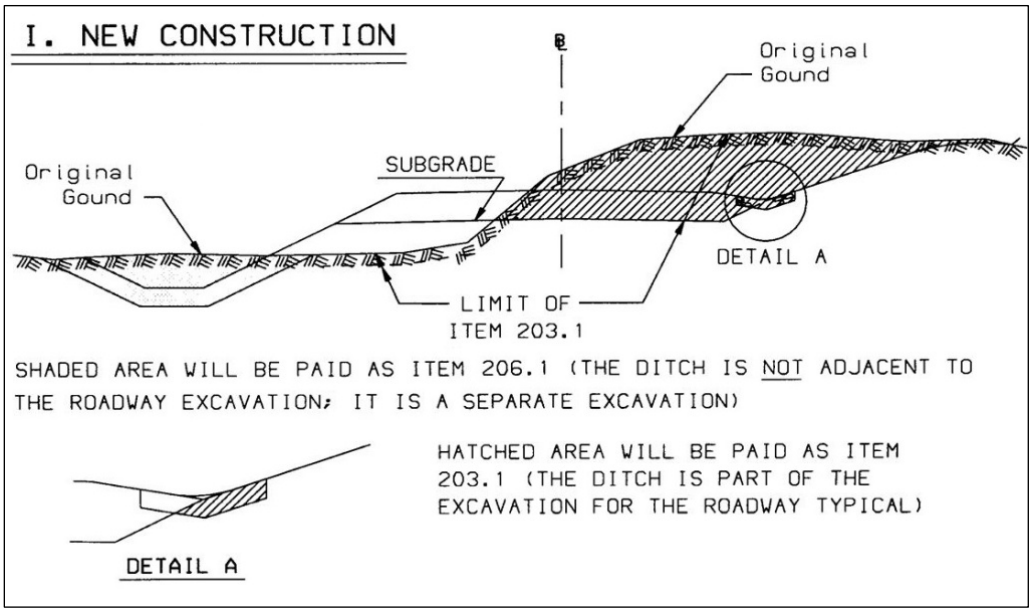


Figure 900 – 3: Roadway and Ditch Excavation Pay Limits – New Construction

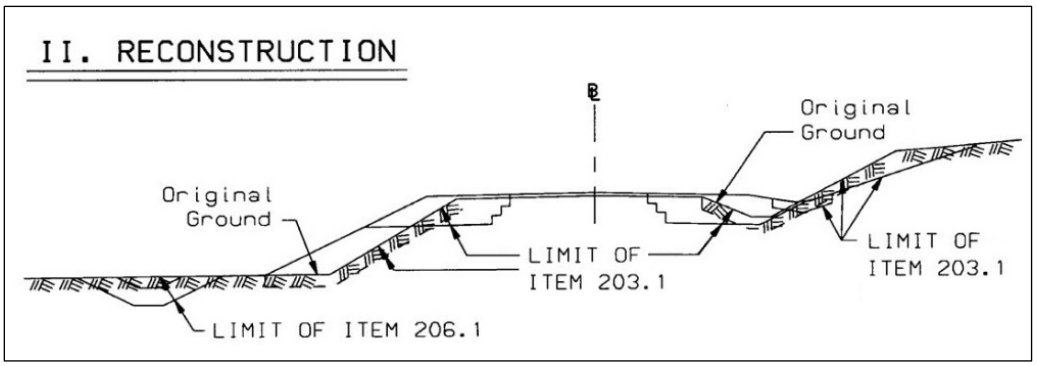


Figure 900 – 4: Roadway and Ditch Excavation Pay Limits – Reconstruction

Source: Fig. 8–5 NHDOT Highway Design Manual – March 1999

903.3 – STRUCTURE EXCAVATION PAY LIMITS

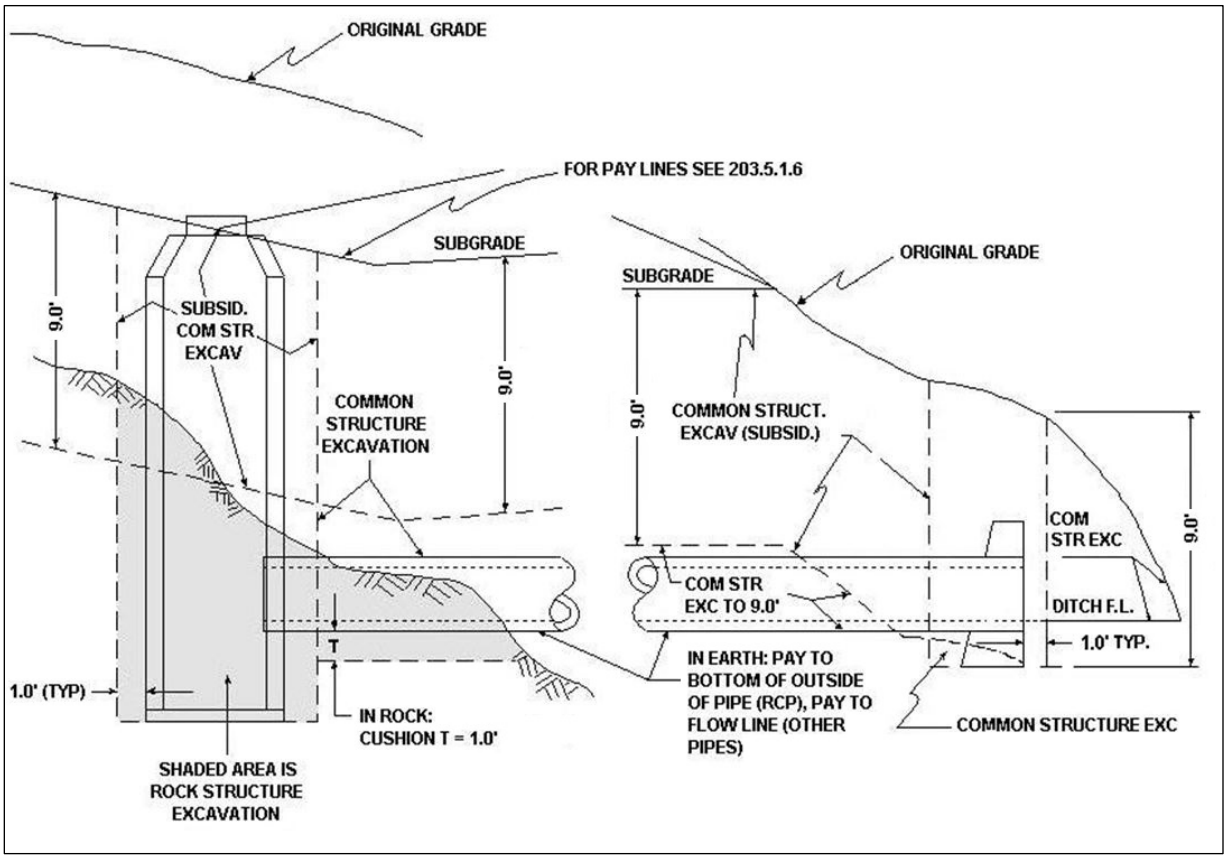


Figure 900 – 5: Structure Excavation Pay Limits

Source: Appendix 8–2 NHDOT Highway Design Manual – March 1999

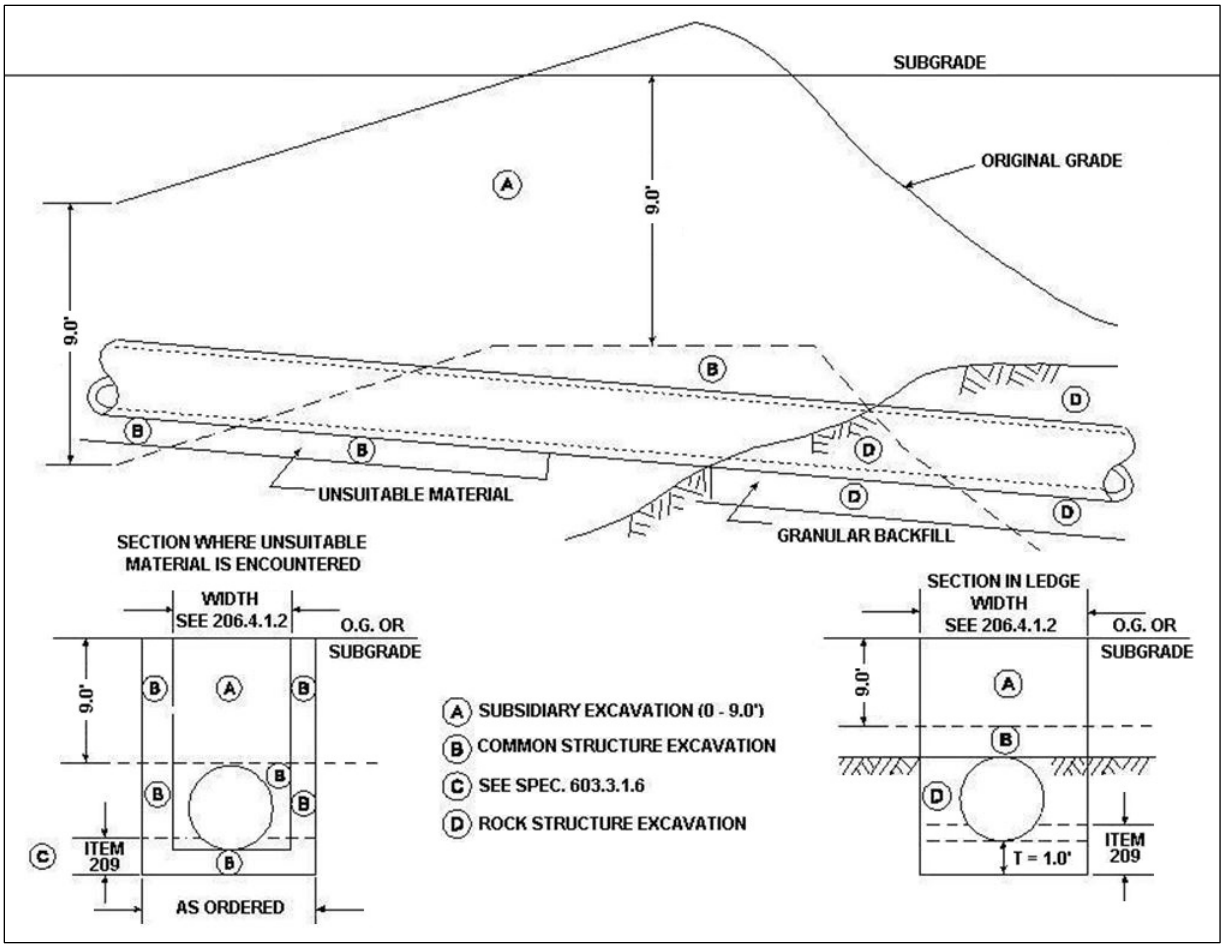


Figure 900 – 6: Structure Excavation Pay Limits

Source: Appendix 8–3 NHDOT Highway Design Manual – March 1999

903.4 –DRAINAGE PIPE PARAMETERS

A. Minimum Storm Runoff Pipe Sizes

Minimum pipe sizes for various storm water runoff conditions are:

- Longitudinal pipes: 12 in
- Slope pipes: 12 in
- Drive pipes: 12 in
- Cross pipes: 15 in

-

B. Minimum Culvert Sizes

Minimum culvert sizes for the major functional classifications of highways are:

- Interstate: 24 in
- Primary, Secondary: 18 in
- State–Aid: 15 in
- Expressway–type highways and highways designed for stage construction: 24 in

C. Minimum Backfill Cover over Pipes

Minimum backfill cover over pipes shall be as shown in the following list:

- Under pavement: 4 ft
- Under drives: 1 ft
- Under non–paved areas: 2 ft

D. Minimum Pipe Slope Requirements

The minimum pipe slope required to maintain a self–cleaning velocity is:

0.4 % (0.004 ft per ft)

or

Sufficient slope to maintain a velocity of 2 fps, flowing one–third full.

If the slope of the pipe is greater than 20%, corrugated pipe with collars should be used.

The minimum gradient of an open water channel or a ditch with a width greater than 10 ft is 0.25%.

A 3 in drop in the flow line at all catch basins or junction structures is desirable as a general rule. However, when excessive depths result, or the velocity exceeds 15 fps, the Hydraulics Section should be consulted.

E. Catch Basin Spacing Requirement

Although the calculated catch basin spacing requirements may specify distances of 500 to 600 ft, actual catch basin spacing should be held to a maximum of 400 ft with an optimum spacing at 300 ft. Basins may be located less than 100 ft apart, which is often the case at sags and at locations with considerable over–the–curb flow. Basins at sags may require supplemental basins placed at short distances on either side with liberal openings provided.

F. Maximum Run for Underdrains

The maximum run for underdrains with a diameter of 6 in shall be 600 ft. For distances over 600 ft, the minimum diameter should be increased to 12 in, or flushing basins should be provided.

G. Manning's Equation

The most common empirical equation used to calculate the cross–sectional average velocity for a pipe flowing full is Manning's Equation.

The Manning Equation states:

$$V = \frac{k}{n} R_h^{2/3} S^{1/2}$$

where,

V = the cross–sectional average velocity in ft/sec,

k = 1.49 (a conversion factor),

n = Manning's Roughness Coefficient,

R_h = the hydraulic radius in ft,

and

S = the slope of the hydraulic grade.

Note: Ks Strickler = 1/n Manning. The coefficient *Ks* Strickler varies from 20 (rough stone and rough surface) to 80 $m^{1/3}/s$ (smooth concrete and cast iron).

Manning's Roughness Coefficients for various types of drainage pipes:

n = 0.010 (Smooth plastic pipe)

n = 0.012 (New RCP)

n = 0.015 (Old RCP)

n = 0.024 (Corrugated pipe – metal or plastic)

Source: NHDOT Manual on Drainage Design for Highways

SECTION 904 – GEOMETRICS

904.1 – LANE DROP TAPERS, PARKING SPACE STALLS, AND VERTICAL CLEARANCES

A. Permanent Lane Drop Tapers

Permanent Lane Drop Tapers	
Design Speed (mph)	Lane Drop Taper
30	30:1
40	40:1
45	45:1
50	50:1
55	55:1
60	60:1
70	70:1

B. Parking Space Stall Dimensions

Parking Space Stall Dimensions	
Stall Type	Stall Dimensions
Stall (High Turnover)	10 ft × 20 ft
Stall (Low Turnover)	9 ft × 18 ft 6 in
Parallel	8 ft × 22 to 26 ft

C. Minimum Vertical Clearances

The NHDOT Highway Design Manual states that "vertical clearance is measured from overhead structures to the finished roadway surface or highest rail of the railroad. The designated clearance must be provided over the entire useable roadway width, including shoulders."

Minimum Vertical Clearances	
Roadway Type	Minimum Vertical Clearance
Local road under Interstate with interchange	16 ft 6 in
Local road under Interstate without interchange	14 ft 6 in
Local road under all other roads	14 ft 6 in
Local road under railroads	14 ft 6 in
State Route under Interstate with interchange	16 ft 6 in
State Route under Interstate without interchange	14 ft 6 in
State Route under all other roads	14 ft 6 in
State Route under railroads	14 ft 6 in
Interstate Route under all roads	16 ft 6 in
Interstate Route under railroads	16 ft 6 in
Railroad under all roads	22 ft 6 in

904.2 – HORIZONTAL CURVES

D = Degree of Curve, Arc Definition
1° = 1 Degree of Curve
2° = 2 Degrees of Curve
P.C. = Point of Curve
P.T. = Point of Tangent
P.I. = Point of Intersection
I = Intersection of Angle; Angle between two tangents
L = Length of Curve, from P.C. to P.T.
T = Tangent Distance
E = External Distance
R = Radius
L.C. = Length of Long Chord
M = Length of Middle Ordinate
c = Length of Sub-Chord
ℓ = Length of Arc for Sub-Chord
d = Angle of Sub-Chord

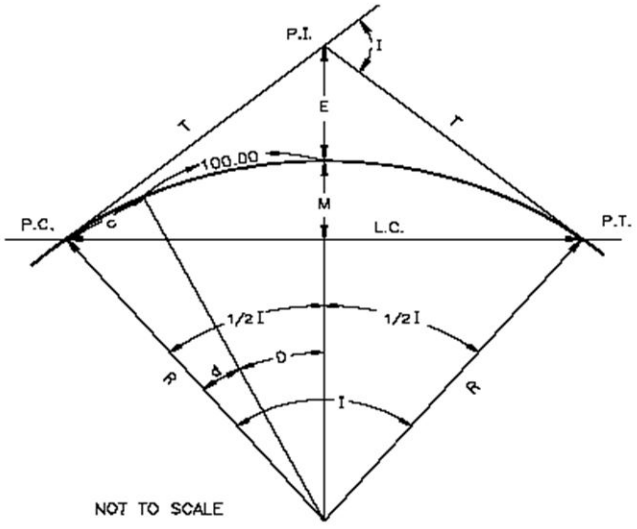


Figure 900 – 7: Horizontal Curve Geometry

$$R = \frac{L.C.}{2\ \sin(I/2)};\quad T = R\tan(I/2) = \frac{L.C.}{2\cos(I/2)}$$

$$\frac{L.C.}{2} = R\sin(I/2);\quad D1° = R = 5{,}729.58;\quad D2° = \frac{5{,}729.58}{2};\quad D = \frac{5{,}729.58}{R}$$

$$M = R[1-\cos(I/2)] = R - R\cos(I/2)$$

$$\frac{E+R}{R} = \sec(I/2);\quad \frac{R-M}{R} = \cos(I/2)$$

$$c = 2R\sin(d/2);\quad d = \frac{\ell D}{100}$$

$$L.C. = 2R\sin(I/2);\quad E = R[\sec(I/2)-1] = R\sec(I/2) - R$$

Figure 900 – 8: Horizontal Curve Element Formulas

Source: http://www.ncees.org/exams/study_materials/land_surveying_equations.pdf

904.3 – HORIZONTAL STOPPING SIGHT DISTANCE

Height of eye: 3.50 ft
Height of object: 0.50 ft
Line of sight is normally 2.00 ft above center line of inside lane at point of obstruction provided no vertical curve is present in horizontal curve.

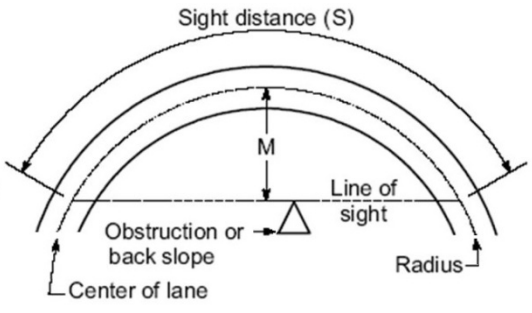


Figure 900 – 9: Sight Distance Parameters

$$M = R\left(1 - \cos\frac{28.65\ S}{R}\right)$$

$$S = \frac{R}{28.65}\left[\cos^{-1}\left(\frac{R-M}{R}\right)\right]$$

S ≤ Length of curve
Angle is expressed in degrees

Figure 900 – 10: Sight Distance Formulas

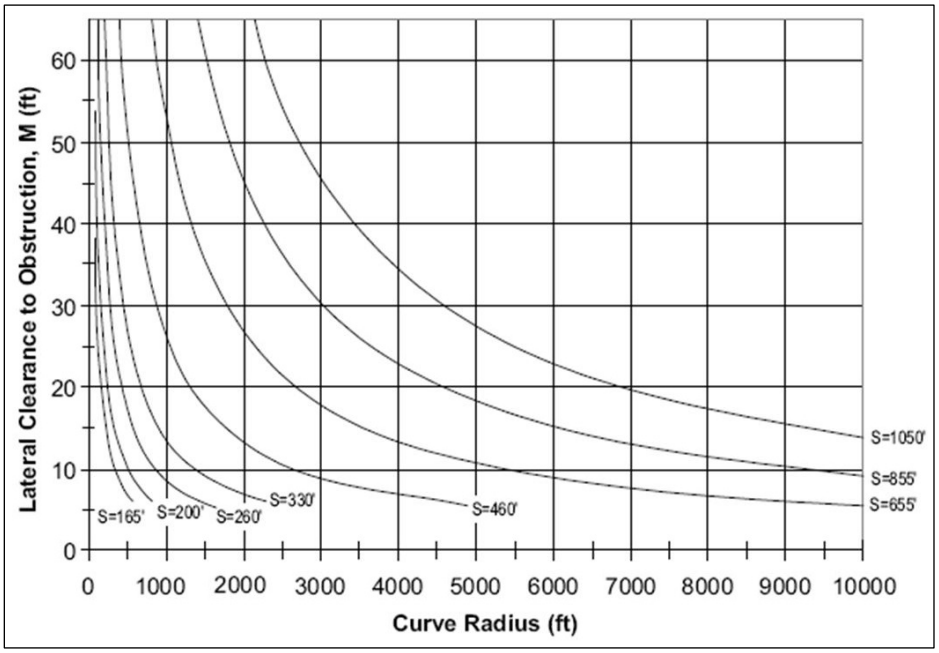


Figure 900 – 11: Horizontal Stopping Sight Distance

Source: *http://www.wsdot.wa.gov/EESC/Design/DesignManual*

904.4 – SIMPLE CURVE SUPERELEVATION TRANSITIONS

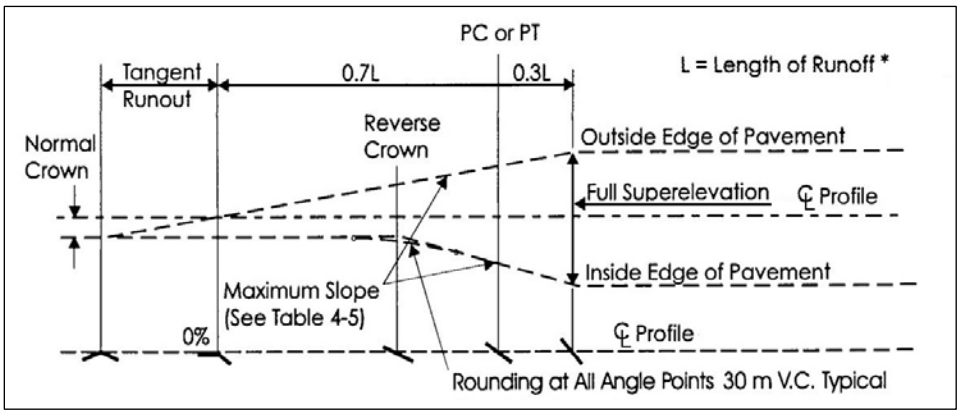


Figure 900 – 12: Superelevation Geometry – Pavement Revolved About Centerline

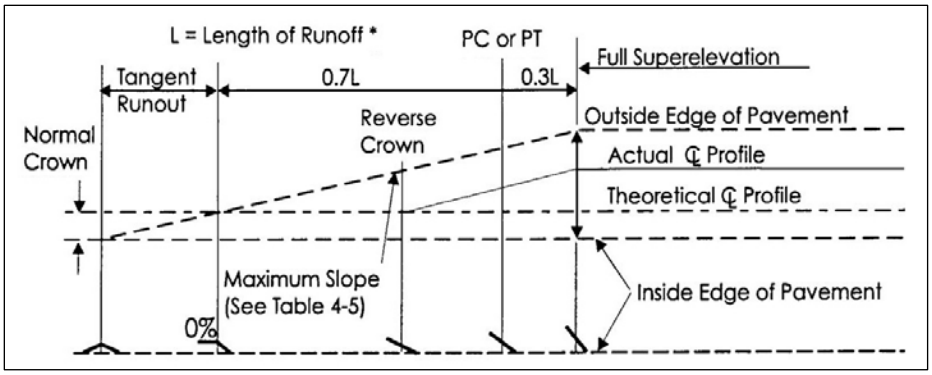


Figure 900 – 13: Superelevation Geometry – Pavement Revolved About Inside Edge

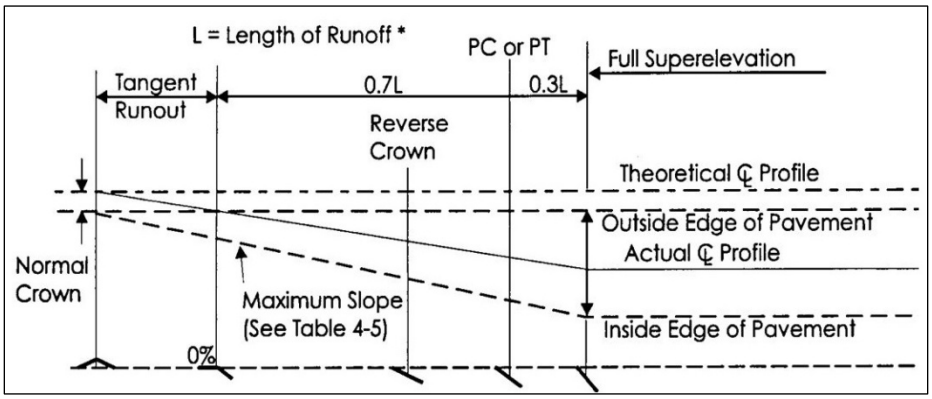


Figure 900 – 14: Superelevation Geometry – Pavement Revolved About Outside Edge

* A 70%–30% split about the PC or PT is the normal distribution

Source: Figure 4–10 NHDOT Highway Design Manual – March 1999

904.5 – VERTICAL CURVES

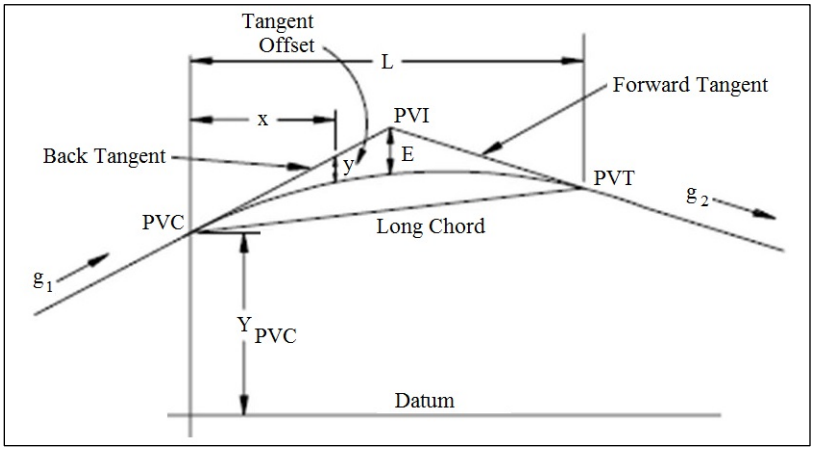


Figure 900 – 15: Vertical Curve Parameters

L	=	Length of Curve	g_2	=	Grade of Forward Tangent
PVC	=	Point of Vertical Curvature	a	=	Parabola Constant
PVI	=	Point of Vertical Intersection	y	=	Tangent Offset
PVT	=	Point of Vertical Tangency	E	=	Tangent Offset at PVI
g_1	=	Grade of Back Tangent	r	=	Rate of Change of Grade

$y = ax^2$

$E = a\left(\frac{L}{2}\right)^2$;

$a = \frac{g_2 - g_1}{2L}$

$r = \frac{g_2 - g_1}{L}$

Tangent Elevation $= Y_{PVC} + g_1x$

Grade Elevation $= Y_{PVC} + g_1x + ax^2$

Figure 900 – 16: Vertical Curve Formulas

Note: Distances x and L are in stations (i.e., 5+00 stations or 5 stations, not 500 ft)

Source: *http://www.ncees.org/exams/study_materials/land_surveying_equations.pdf*

A. High and Low Point Calculations

X = distance in stations from PVC to high/low point of curve

$X = g_1 L / (g_1 – g_2)$

Example

If: g_1 = + 3.0%, g_2 = – 2.4%, L = 600 ft, PVI is @ Sta. 46+70 @ elev. 853.48.

Find: The PVC, PVT, intermediate, and high point stations and elevations (curve is an equal tangent curve).

Stationing:

PVI = 46 + 70

L / 2 = 3 + 00

PVC = 43 + 70

+ L= 6 + 00

PVT = 49 + 70

Elevation at PVC:

Y_{PVC} = 853.48 – 3.00(3) = 844.48

Calculate elevations at even stations:

r = (–2.4 – 3.0) / 6 stations = – 0.9 % / station,

$Y = Y_{PVC} + g_1x + ax^2 = Y_{PVC} + g_1x + rx^2/2$.

Refer to the following table for the vertical curve data used in this example.

Vertical Curve Table				
Station	x	g_1x	$Rx^2 / 2$	Curve Elevation (Y)
49+70 (PVT)	6.0	18.00	–16.20	846.28
49+00	5.3	15.90	–12.64	847.74
48+00	4.3	12.90	–8.32	849.06
47+00	3.3	9.90	–4.90	849.48
46+00	2.3	6.90	–2.38	849.00
45+00	1.3	3.90	–0.76	847.62
44+00	0.3	0.90	–0.04	845.34
43+70 (PVC)	0.0	0.00	0.00	844.48
Check EVC = 853.48 – 2.40(3) =846.28				

Calculate high point information:

$X = g_1L / (g_1 – g_2) = 3.00(6) / (3.00 – (–2.4)) = 3.3333$ stations

$Sta_{high} = 43+70 + (3+33.33) = 47 + 03.33$

$Y_{high} = Y_{PVC} + g_1x + rx^2 / 2 = 844.48 + 3.00\ (3.3333) – 0.9\ (3.3333)^2 / 2 = 849.48$

Note: It is important that correct algebraic signs be used in all of the equations above.

B. Passing Sight Distance Calculations

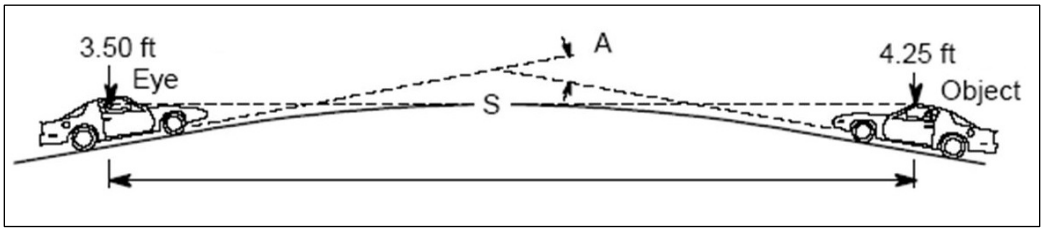


Figure 900 – 17: Passing Sight Distance Parameters

Formulas:

When S is less than L

$L = AS^2/3093$

When S is greater than L

$L = 2S - 3093/A$

S = Sight distance in feet

L = Length of vertical curve in feet

A = Algebraic difference of grades in percent

Figure 900 – 18: Passing Sight Distance Formulas

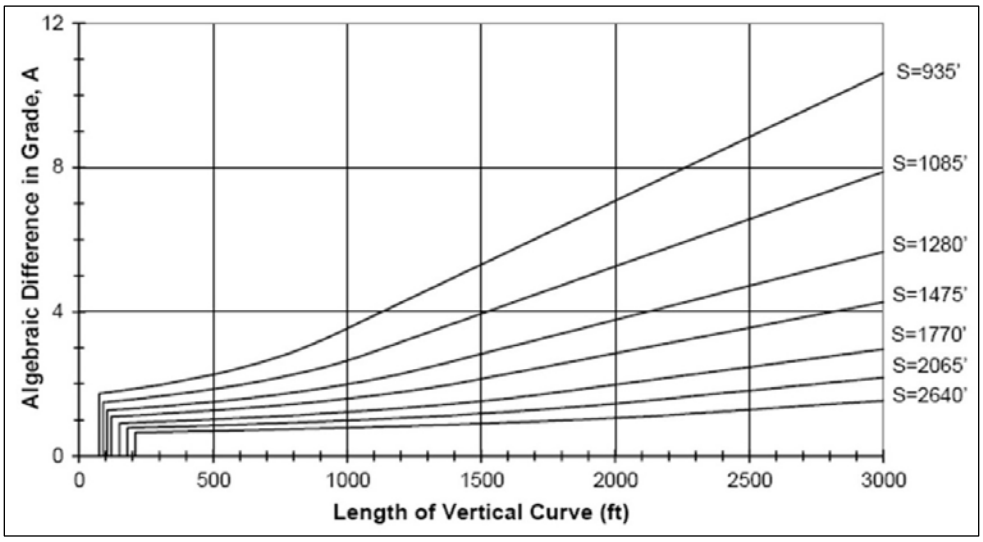


Figure 900 – 19: Passing Sight Distance for Crest Vertical Curves

Source: http://www.wsdot.wa.gov/EESC/Design/DesignManual

C. Length of Vertical Curve and Stopping Sight Distance Calculations

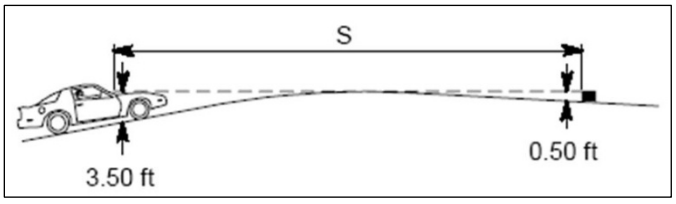


Figure 900 – 20: Vertical Curve Length Parameters

When S > L	When S < L
L = 2S - 1329/A (not used in figure)	$L = AS^2/1329$
L = Curve length (ft) A = Algebraic grade difference (percent) S = Sight distance (ft)	

Figure 900 – 21: Vertical Curve Length Formulas

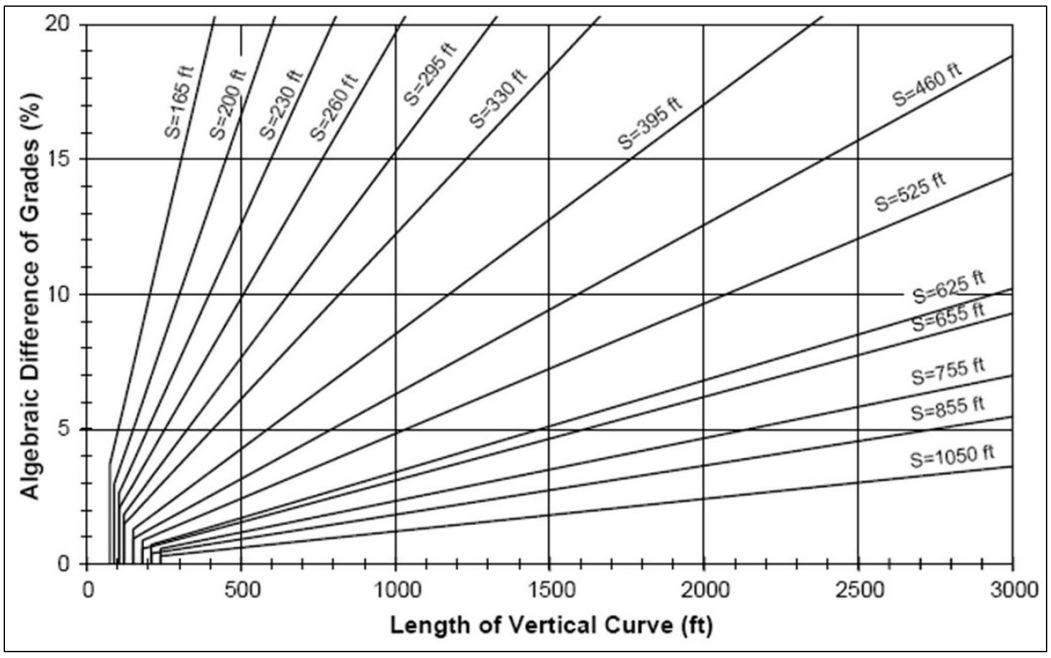


Figure 900 – 22: Stopping Sight Distance for Crest Vertical Curves

Source: *http://www.wsdot.wa.gov/EESC/Design/DesignManual*

SECTION 905 – WEIGHTS AND BEARING CAPACITIES OF MATERIALS

905.1 – WEIGHTS OF MATERIALS

Weights of Materials (1)			
Material	Weight (lbs/ft^3)	Material	Weight (lbs/ft^3)
Aluminum:		Gravel	
Cast	165	Crushed rock, damp, loose	82–125
Wire	168	Cr. rock, dry, compacted	90–145
Asphalt	60–80	Stony, loose in truck	3200 lbs / yd^3
Rolled (lbs per yd^2 per in)	100–110	Stony, compacted in road	3800 lbs / yd^3
Brass	510–542	Ice:	56
Brick	110–130	Iron:	
Cement, Portland (1 ft^3 bag)	94	Grey cast	439–445
Coal, piled:		Wrought	487–492
Anthracite	47–58	Lead	710
Bituminous	40–54	Lime	53–75
Concrete:		Masonry:	
Reinforced	150	Mortar rubble	155
Plain	140–150	Dry rubble	125
Concrete Aggregate		Rock, solid:	
Dry, rodded	100–105	Granite	125–187
Copper, cast	549–558	Shale	162
Earth:		Soapstone	162–175
Clay:		Trap	187–190
Dry	63	Salt, granulated	50–70
Dry, compacted	100	Snow:	
Damp	110	Fresh, fallen	5–12

Weights of Materials (2)				
Material	Weight (lbs/ft^3)		Material	Weight (lbs/ft^3)
Earth:			Snow:	
Common:			Wet, compact	15–20
Dry, loose	76		Steel	474–494
Dry, compacted	95		Tar	75
Moist, loose	78		Tin	455
Moist, compacted	96		Water:	
River mud	90		Fresh	62.4
Sand:			Fresh	8.33 lbs / gal
Wet, loose – 4% moist.	89		Fresh	7.5 gal / ft^3
Dry, loose	100		Sea	64
Dry, rodded	105		Zinc	438

Note: All weights listed are approximate

905.2 –BEARING CAPACITIES OF MATERIALS

Bearing Capacity of Various Materials		
Material	Bearing Capacity (tons/ft^2)	Bearing Capacity (lbs/ft^2)
Clay, soft	1	2,000
Clay, hard	6	12,000
Clay, medium	4	8,000
Sand and clay mixed	2	4,000
Sand, fine, loose	1	2,000
Sand, coarse, loose	3	6,000
Sand (dry), fine, compact	3	6,000
Sand (dry), coarse, compact	4	8,000
Sand and gravel mixed (loose)	4	8,000
Sand and gravel mixed (compact)	5	10,000
Gravel, compact	6	12,000
Rock, soft	8	16,000
Rock, medium	15	30,000
Rock, hard	35	70,000
Hardpan	10	20,000
Shale, in sound condition	10	20,000

Note: The values listed in this table are approximate; the actual bearing capacity of soils depends on the composition, the moisture content, and the extent of the strata. Local building codes usually specify the allowable bearing capacity of soils.

Source: Parmley, Robert O., Field Engineer's Manual, 2nd Edition, Copyright © 1995 by McGraw–Hill, Inc., New York, NY

SECTION 906 – TRAFFIC CONTROL

906.1 – TRAFFIC CONTROL CHECKLIST

Refer to the following "memory jogger" list to manage all of the traffic control elements for the project, including signage.

A. Portable Changeable Message Signs (PCMS) – Deployment

Portable Changeable Message Signs shall be deployed with the following parameters:

Figure 900 – 23: Portable Changeable Message Sign (PCMS)

- The PCMS shall be located so that it is clearly visible to motorists and project personnel, and free from blockage by any obstructions, including other signs, vegetation, etc.
- The PCMS shall be located so that it doesn't block any other signs.
- Each PCMS shall display only two phases, or messages, at one time.
- The PCMS message displayed shall not be a duplicate of any other visible construction sign in the same vicinity.
- Additional PCMS units shall be used for additional message displays.
- The PCMS message shall consist of up to three lines with eight characters per line and shall be center-justified.
- The PCMS message shall be displayed in letters that are at least 18 in high.
- The PCMS message may use abbreviations as noted in Section 1A.14 Meanings of Acronyms and Abbreviations in this Manual of the MUTCD.
- The PCMS message shall be visible a minimum distance of 650 ft.
- The PCMS message shall have an adjustable display rate so that the entire message can be read at least twice by motorists when driving at the posted speed limit.
- The PCMS message shall not scroll horizontally or vertically across the face of the sign.
- The PCMS shall be mounted at a minimum height of 7 ft off EP in urban areas and divided highways, and at a minimum height of 5 ft off the EP in rural areas.
- The PCMS location shall be delineated with appropriate traffic control devices, such as barrels.
- The trailer carrying the PCMS shall feature high–visibility retroreflective material.
- When the PCMS is not in use, it shall be removed from the clear zone unless adequately protected by appropriate portable barriers or their equivalent; refer to *Subsection 619.3.2.6.3* of the Standard Specifications for more information.
- When the PCMS is not in use, the message board shall be turned parallel to traffic.

B. Permanent Construction Signs – Deployment

Permanent construction signs shall be deployed with the following parameters:

- Permanent construction signs to be deployed on the project are listed on the Construction Signs and Warning Devices (CSWD) summary sheet which is included in the project plans or proposal.
- The typical layout for permanent construction signs is specified on the Work Zone Traffic Control (WZTC) Standard Plans #2.

- Permanent construction signs shall be located so as to avoid blocking any other roadway signs; refer to Note #2 on WZTC Standard Plans #1.
- The format of permanent construction sign text shall follow the NHDOT Construction Sign Standards and Standard Highway Signs.
- Permanent construction signs shall feature fluorescent orange sheeting.
- Permanent construction signs dimensions shall be 48 in x 48 in, unless in urban areas or so noted on the CSWD summary sheet.
- Permanent construction signs shall be mounted on two U–channel posts, unless noted differently on the CSWD summary sheet.
- Permanent construction signs posts shall be installed flush with the top of the sign or 6 in below the sign; posts shall not extend over the sign.
- Permanent construction sign U–channel posts may be spliced, typically at 6 in; refer to the testing data in *NCHRP 350.*
- Permanent construction sign posts shall be embedded at a minimum depth of 2 ft 6 in.
- Permanent construction signs shall be mounted at a minimum height of 7 ft off EP in urban areas and divided highways, and at a minimum height of 5 ft off the EP in rural areas.
- Permanent construction signs not in use shall be removed or completely covered with an approved material, such as plywood.

C. Traffic Channelizing Devices – Deployment

Traffic channelizing devices shall be deployed with the following parameters:

- Traffic channelizing device spacing for tangent use is twice the speed limit.
- Traffic channelizing device spacing on tapers is the speed limit.

D. Traffic Cones – Deployment

Traffic cones shall be deployed with the following parameters:

Figure 900 – 24: Traffic Cones

- Traffic cones may be deployed at night only during work hours.

- Traffic cones deployed during non–work hours may only be used at night to supplement other channelizing devices, such as drums or barricades, although the drums and barricades shall maintain their required spacing.
- Cones deployed at night shall have a height of at least 28 in.
- Cones deployed at night shall have two retroreflective bands around the cone, the first 6 in band located 3 to 4 in from the top of the cone and the second 4 in band located 2 in below the 6 in band.

E. Construction Barrels (Drums) – Deployment

Construction barrel shall be deployed with the following parameters:

Figure 900 – 25: Construction Barrel (Drum) with Additional Signaling Device

- Drums shall be predominately orange as specified on the WZTC Standard Plans #1.
- Drums shall have a minimum height of 36 in.
- Drums shall have two alternating orange and two white retroreflective stripes 4 to 6 in wide, with an orange top stripe.
- Spaces between the stripes shall not exceed 3 in.
- Drums shall be properly ballasted at all time; ballast shall not be placed on top of any drum.

F. Barricades – Deployment

Barricades shall be deployed with the following parameters:

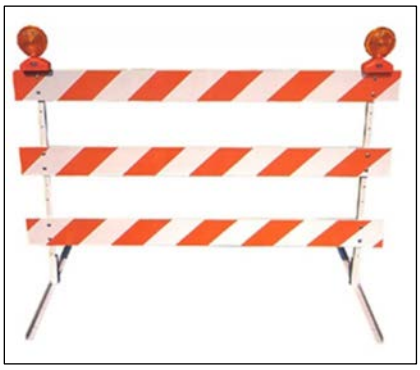


Figure 900 – 26: Traffic Barricade

- Type I and II barricades shall to be deployed to direct motorists through the work zone.
- Type I barricades are typically deployed on conventional roads or urban streets.
- Type II barricades are typically deployed on Divided Highways or other high–speed roadways with a speed limit greater than 45 mph.
- Type III barricades are primarily used for road closures or partial closures.
- Barricade rails shall be 8 to 12 in wide.
- Barricade stripes shall be alternating orange and white retroreflective oriented downward at an angle of 45º in the direction motorists are to pass.
- Barricade stripes shall be 6 in wide except when rail lengths are less than 3 ft, in which case 4 in stripes may be used.
- Type I and II barricade rails shall have a minimum length of 24 in and a minimum height to the top of rail from the ground surface of 3 ft.
- Type III barricade rails shall have a minimum length of 4 ft and a minimum height to the top of rail from the ground surface of 5 ft.

G. Operational Construction Signs – Deployment

- Operational construction signs shall be mounted on an approved *NCHRP 350* portable sign stand.
- Operational construction signs shall be mounted with the bottom of the sign at a minimum clearance above the travelway of 1 ft.
- Operational construction signs shall indicate cold planed areas in the work zone with the following signs:
  - "Motorcycles Use Caution"
  - "Grooved Pavement Ahead"
  - "Bump or Dip"
- NHDOT guidelines require that a "Be Prepared to Stop" sign is displayed along with any "Flagger" signs

H. Flaggers – Deployment

Flaggers for traffic control shall be deployed with the following parameters:

- Flaggers deployed on the project shall have proper certification.
- Flagger apparel shall meet MUTCD requirements and include an approved hard hat or orange baseball cap, shirt, and safety vest.

- The flagger's stop/slow paddle shall be 18 in wide with 6 in high letters on a retroreflective background.
- Signaling with hand signals and stop/slow paddles shall be conducted following the MUTCD guidelines and NHDOT *Flagger Handbook.*
- Flaggers shall use 2–way radios to control traffic.
- When the flagger is on duty, "Flagger Ahead" and "Be Prepared to Stop" signs shall be properly positioned in place.
- When the flagger is off duty, "Flagger Ahead" and "Be Prepared to Stop" signs shall be removed.
- Flagger stations shall be maintained in clean condition; distractions such as books, chairs, radios, and congregating personnel are prohibited.
- Flagger stations shall be positioned on the roadway shoulder of the approaching traffic outside of the lane closure as specified in the MUTCD and NHDOT *Flagger Handbook.*
- Flaggers shall not be stationed in the travel lane.
- Flagger operations and stationing shall be reviewed throughout the day for their visibility under changing light conditions.
- Flaggers on duty shall not leave their station for any reason.
- Flaggers shall request assistance from project personnel for picking up any signs, barrels, cones, etc., that may be out of position.
- Flaggers shall employ proper flagging etiquette.
- Flaggers shall conduct themselves appropriately and send a clear, respectful message to passing motorists.
- Flaggers shall not conduct flagging operations from inside any vehicle.
- Flaggers shall know the proper procedure for directing emergency vehicles through the work zone.
- Flaggers shall know the proper procedure for dealing with any vehicular or other accident that occurs inside the work zone.
- Flaggers shall know the proper procedure for dealing with a motorist who ignores flagger direction and "runs" the flagger station.
- The Contractor shall ensure that the flagger has been briefed on the expectations for the traffic control operation.
- The Contractor shall verify the proper visibility of all signs and flaggers in the work zone.
- The Contractor shall ensure that the flagger receives proper rest breaks.

I. Pre–Construction Meeting – Traffic Control Operations Review

The traffic control operations for the project shall be discussed in the pre–construction meeting, including the following:

- The Contractor shall introduce their Traffic Control Coordinator to the project team.
- The Contractor shall verify that the proper traffic control documents are being used on the project.
- The Contract Administrator shall review *NCHRP 350* requirements with the Contractor.
- The traffic control layout shall be reviewed by the project team.
- The traffic control layout shall be performed prior to erecting any permanent construction signs.
- NHDOT shall approve only the final traffic control product, not the layout.
- The Contract Administrator shall consult with the Contractor regarding likely locations for PCMS units.
- The Contractor shall remove any PCMS units from the clear zone when they are not in use.
- The Contractor shall have the proper operational signs on site to use in case of emergencies and/or unforeseen circumstances.
- Traffic control devices shall be inspected for the following parameters before implementation:
- Proper sign wording, text, size, sheeting intensity, etc.
- Proper posts
- Proper condition of channelizing devices
- Proper working conditions of arrow boards and PCMS units

J. Pavement Markings – Deployment

Pavement markings shall be deployed with the following parameters:

- Careful monitoring of the work zone conditions prior to, during, and after the implementation of a traffic control plan is essential to safe operations.
- All temporary pavement markings must be in compliance with the project's traffic control plan.
- Temporary pavement markings may consist of paint, tape, or removable raised pavement markers.

- Temporary pavement markings are installed on an interim basis prior to final pavement markings.
- Pavement markings installed on detours or winter binder pavement are not considered temporary pavement markings; these markings are paid for under Item 632 and shall follow the proper Specifications.
- Temporary pavement markings shall not be left in place for more than two weeks, except for temporary raised pavement markers on divided highways, which shall not be in left place for more than one week.
- All temporary pavement markings shall be maintained in place while in service.
- All temporary pavement markings, if dislodged or rendered ineffective, shall be immediately replaced.
- Temporary raised pavement markers shall not be used to supplement or substitute edgelines and non–longitudinal lines, e.g., stop lines, railroad crossings, crosswalks, words, symbols, etc.
- Edgelines, channelizing lines, lane reduction transitions, gore markings, and non–longitudinal lines are usually not required for temporary pavement unless directed by the Engineer; refer to the WZTC standard plans for more information.
- Raised pavement marker spacing for the double yellow centerline on two–way roadways is 40 ft; at the Engineer's discretion, "Do Not Pass" (R4–1) signs may be installed for added emphasis.
- Raised pavement markers for the double yellow centerline shall be yellow double–face retroreflectorized markers placed in pairs.
- Raised pavement markers on divided highways shall also be spaced at 40 ft for the single broken line.
- Raised pavement markers on divided highways shall be white single–face retroreflectorized markers.
- The current NHDOT Qualified Products List should be consulted for approved raised pavement markers noted under 619 Items.
- Pavement markings that are longer applicable to current conditions in the work zone shall be completely removed.
- Inspectors shall conduct occasional drive–throughs of the project during both day and night to verify that the markings are clearly visible, the white markings appear to be white, and the yellow markings appear to be yellow.
- The Contractor shall correct any situations in which the temporary pavement markings are found to be unsatisfactory, including repainting lines.

906.2 – ACCIDENTS – EMERGENCY NOTIFICATION PROCEDURE

Any accidents that occur on the project, whether involving project personnel or the travelling public, must be properly reported.

To assure timely and informative notification in the event of an emergency or catastrophic situation that may involve:

- Death, dismemberment, or severe injury requiring hospitalization of DOT employees.
- Death, dismemberment, or severe injury to members of the public when DOT employee conduct may be a contributing factor.
- Major property damage and/or loss of physical assets.
- Bridge failure or road failure.
- Severe/negative impact upon public relations.

Note: NHDOT employees are encouraged to act as "Good Samaritans," using good judgment and common sense when confronted with emergency incidents not involving Department employees, property, or equipment.

906.3 – SAFETY CONCERNS – CONSTRUCTION SITE HAZARDS

Field Supervisors must ensure that project personnel for whom they are responsible, as well as visitors to the project, are aware of all relevant safety concerns in the work zone. The following is a partial list of common hazards and conditions of which to be aware.

- Competing Noise: Loud machinery makes it difficult to hear the approach of other potentially dangerous equipment; constant vigilance is required in noisy conditions.
- No Backup Beeper Sounding: Some equipment such as an excavator can spin around so that its tracks go forward but its cab is going backward with no backup beeper sounding; verify the equipment's direction and course before venturing anywhere near it.
- Making Operator Eye Contact: Excavator operators must rely on mirrors to see to the right of the boom and other types of equipment pose their own sightline problems for their operators; make eye contact with the equipment operator so they know that personnel are nearby.
- Pavement Burns: Freshly–laid pavement may have a temperature of 350°F or higher; avoid contact with freshly–laid pavement to prevent being burned.
- Welder Blindness: Welding involves the generation of UV radiation that is injurious to the eyes; direct observation of the electric welding arc without proper protective eyewear is prohibited.
- Compressor Hoses: Compressor hoses are often subjected to high pressure conditions that cause them to abruptly shift position or even rupture; tread carefully around compressor hoses, which may also be a tripping hazard.

- Stud Welding Cables: Stud welding cable lines may not be insulated properly, posing a serious electric shock hazard; avoid touching any stud welding cable lines.
- Driving in Construction Work Zones: An inexperienced person driving through a construction work zone may encounter any number of potential hazards; caution must be exercised at all times when driving through a construction work zone to maintain safe conditions.
- Blasting Whistles: Proper precautions must be taken in areas where blasting operations are being conducted and that includes heeding the blasting whistle that precedes the detonation to ensure that personnel safety is not compromised; famous last words: "That must be the lunch whistle…"
- Unstable Rock: Walking in areas covered with newly–blasted rock, Class B stone, or any other areas with unstable footing conditions should be discouraged.
- Oncoming Traffic: Project personnel working in the road should be aware of the traffic conditions at all times, with at least one person facing traffic constantly monitoring the situation and ready to alert personnel to any potential approaching hazards.
- Dump Truck Loading: Project personnel should avoid getting too close to a dump truck as it is being loaded, as the loaded material may spill over and cause injury.
- Excavator/Crane "Pinch Areas": Articulated machines such as excavators and cranes have "pinch areas" where it is possible to become trapped and crushed by moving apparatus during the machine's operation; "pinch areas" should be roped off to prevent injury to project personnel.
- Cold Planer "Jump Back": Cold planer equipment may abruptly jump back if not properly set down while the planing drum is spinning; maintain a safe distance from cold planing equipment during cold planing operations.
- Rebar Impalement: Care must be exercised around exposed reinforcing steel bars so as to avoid impalement; OSHA safety caps should be placed on rebar ends to prevent any injuries.
- Unfinished Staging: Before project personnel walk on any staging, they should verify that the staging installation has been completed and it is safe to access.

Source: NHDOT Traffic Section

906.4 – OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA) REQUIREMENTS

The U.S. Occupational Safety & Health Administration has requirements for construction work zone safety that cover many different conditions and situations.

A. Fall Protection

OSHA 1926.501 (b)(1)

Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 ft or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

OSHA 1926.501 (b)(5)

Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 ft or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.

OSHA 1926.760 (a)(1)

Each employee engaged in a steel erection activity that is on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems.

B. Trench Safety

OSHA 1926.651 (c)(2)

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are ≥4 ft. The exit ladder must be within 25 ft of all workers in the trench.

OSHA 1926.651 (j)(2)

Excavated materials must be at least 2 ft away from the edge of the excavation or trench.

OSHA 1926.652 (a), (b), and (c)

Adequate protective systems (for example, trench boxes, shoring, sloping, stepped or benched grades) are required in excavations ≥5 feet deep, unless in stable rock.

OSHA 1926.652 (b)(1)(i)

If 5 ft trenches are not otherwise protected, the sides of the excavation shall be sloped no steeper than 1.5 H: 1 V.

OSHA 1926.652 (e)(2)(i) and 1926.652 (g)(2)

Excavation of material to a level no greater than 2 ft below the bottom of the members of a support system or trench box shall be permitted and only if ground conditions are stable.

C. Reinforcing Steel Safety

OSHA 1926.701 (b)

All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement.

D. Structural Steel Safety

OSHA 1926.754 (c)(l)(i)

Shear connectors, reinforcing bars, etc., shall not be attached to the top flanges of beams so that they project vertically from or horizontally across the top flange until after another walking/working surface has been installed.

E. Utility Safety

OSHA 1910.333 (c)(3)(i)(A) and 1910.333 (c)(3)(i)(B)

When an "unqualified" person* is working in an elevated position near overhead lines or on the ground in the vicinity of overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

- For voltages to ground 50kV or below – 10 ft
- For voltages to ground over 50kV – 10 ft plus 4 in for every 10kV over 50kV.

***** An "unqualified" person in this context is anyone that does not work for a utility company.

OSHA 1910.333 (c)(3)(iii)(A)

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10kV over that voltage. However, under any of the following conditions, the clearance may be reduced:

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

F. Water Safety

OSHA 1926.106 (a)

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard–approved life jacket or buoyant work vests.

OSHA 1926.106 (c)

Ring buoys with at least 90 ft of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 ft.

OSHA 1926.106 (d)

At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

SECTION 907 – DRIVEWAYS AND OTHER ACCESSES TO THE PUBLIC WAY

907.1 – GENERAL

The regulation of driveways and other accesses to the public way is set forth in the following statute:

New Hampshire Revised Statutes: Title XX, Transportation, Chapter 236, Highway Regulation, Protection and Control Regulations, Excavations and Driveways, § 236:13, Driveways and Other Accesses to the Public Way

This statute may be found on the New Hampshire General Court's website at the following URL:

http://www.gencourt.state.nh.us/rsa/html/XX/236/236–13.htm

Title XX, Transportation, Chapter 236, Highway Regulation Protection and Control Regulations, Excavations and Driveways § 236:13, Driveways and Other Accesses to the Public Way

It shall be unlawful to construct, or alter in any way that substantially affects the size or grade of, any driveway, entrance, exit, or approach within the limits of the right–of–way of any class I or class III highway or the state maintained portion of a class II highway that does not conform to the terms and specifications of a written permit issued by the commissioner of transportation (Amended 1985, *402:6, I(b)(7)*).

Pursuant to this section, a written construction permit application must be obtained from and filed with the department of transportation by any abutter affected by the provisions of paragraph I. Before any construction or alteration work is commenced; said permit application shall have been reviewed, and a construction permit issued by said department. Said permit shall:

Describe the location of the driveway, entrance, exit, or approach. The location shall be selected to most adequately protect the safety of the traveling public.

Describe any drainage structures, traffic control devices, and channelization islands to be installed by the abutter.

Establish grades that adequately protect and promote highway drainage and permit a safe and controlled approach to the highway in all seasons of the year.

Include any other terms and specifications necessary for the safety of the traveling public (Amended 1985, *402:6, I(a)(7)*).

For access to a proposed commercial or industrial enterprise, or to a subdivision, all of which for the purposes of this section shall be considered a single parcel of land, even though acquired by more than one conveyance or held nominally by more than one owner:

Said permit application shall be accompanied by engineering drawings showing information as set forth in paragraph II.

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Title XX, Transportation, Chapter 236, Highway Regulation Protection and Control Regulations, Excavations and Driveways § 236:13, Driveways and Other Accesses to the Public Way

Unless all season safe sight distance of 400 feet in both directions along the highway can be obtained, the commissioner shall not permit more than one access to a single parcel of land and this access shall be at that location which the commissioner determines to be safest. The commissioner shall not give final approval for use of any additional access until it has been proven to him [her] that the 400 foot all–season safe sight distance has been provided.

For the purposes of this section, all season safe sight distance is defined as a line which encounters no visual obstruction between 2 points, each at a height of 3 feet 9 inches above the pavement, and so located as to represent the critical line of sight between the operator of a vehicle using the access and the operator of a vehicle approaching from either direction.

No construction permit shall allow:

A driveway, entrance, exit, or approach to be constructed more than 50 feet in width, except that a driveway, entrance, exit, or approach may be flared beyond a width of 50 feet at its junction with the highway to accommodate the turning radius of vehicles expected to use the particular driveway, entrance, exit or approach.

More than 2 driveways, entrances, exits or approaches from any one highway to any one parcel of land unless the frontage along the highway exceeds 500 feet.

The same powers concerning highways under their jurisdiction as are conferred upon the commissioner of transportation by paragraphs I, II, III and IV, shall be conferred upon the planning board in cities and towns wherein the planning board has been granted the power to regulate the subdivision of land as provided in RSA 674:35 and, they shall adopt such regulations as are necessary to carry out the provisions of this section (Amended 1985, *103:4*, effective Jan. 1, 1986; *402:6, I(b)(7)*).

RSA 236:14 Penalty. Any person who violates any provision of this subdivision or the rules and regulations made under authority thereof shall be guilty of a violation if a natural person, or guilty of a misdemeanor if any other person; and, in addition, shall be liable for the cost of restoration of the highway to a condition satisfactory to the person empowered to give such written permission.

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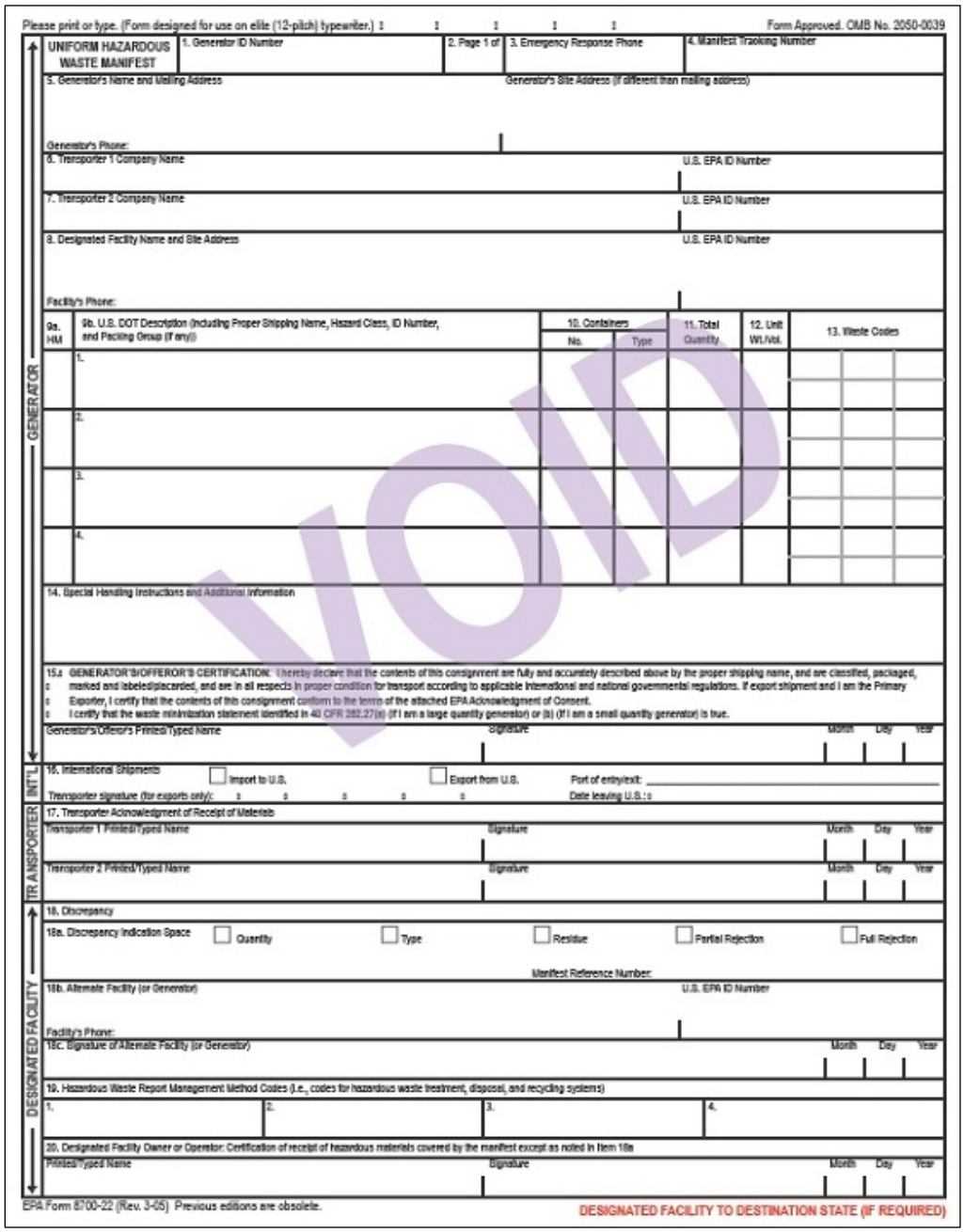
SECTION 908 – HAZARDOUS WASTE MANAGEMENT

908.1 – HAZARDOUS WASTE MANIFEST DISTRIBUTION

Hazardous waste, that is material that poses substantial or potential threats to public health or the environment, shall be treated, stored, and disposed of properly. Hazardous waste, once generated, must be removed by an approved hazardous waste transporter to an EPA–authorized Treatment, Storage, and Disposal Facility (TSDF).

Information regarding TSDF hazardous waste management requirements may be found on the U.S. Environmental Protection Agency website at the following URL: https://www.epa.gov/hw



The hazardous waste transporter shall submit the hazardous waste generator with six copies of the Hazardous Waste Manifest, an inventory of transported materials, when the hazardous waste is picked up. The hazardous waste generator shall review the manifest for accuracy and signs all six copies, then make two additional copies.

The hazardous waste generator shall retain one copy and submit the remaining seven signed copies of the manifest to the following parties:

- (1) copy: Hazardous Waste Generation Facility
- (5) copies: Hazardous Waste Transporter
- (1) copy: New Hampshire Department of Environmental Services
- Must be received within five days of hazardous waste shipment
- (1) copy: Department of Environmental Services of the State in which the TSDF is located

  Must be received within five days of hazardous waste shipment

The hazardous waste transporter shall retain one copy and submit the remaining four signed copies of the manifest to the TSDF when the hazardous waste is delivered to the TSDF.

The TSDF, in turn, shall retain one copy and distribute the remaining copies of the signed manifest to the following parties:

- (1) copy: TSDF
- (1) copy: Hazardous Waste Generation Facility

  If the hazardous waste generator has not received their copy of the manifest from the TSDF within 35 days, the TSDF or hazardous waste transporter must be contacted to determine the status of the hazardous waste shipment

  If the hazardous waste generator has not received their copy of the manifest from the TSDF after 45 days, the generator must send written notification and a copy of the manifest to the New Hampshire Department of Environmental Services
- (1) copy: New Hampshire Department of Environmental Services
- (1) copy: Department of Environmental Services of the State in which the TSDF is located

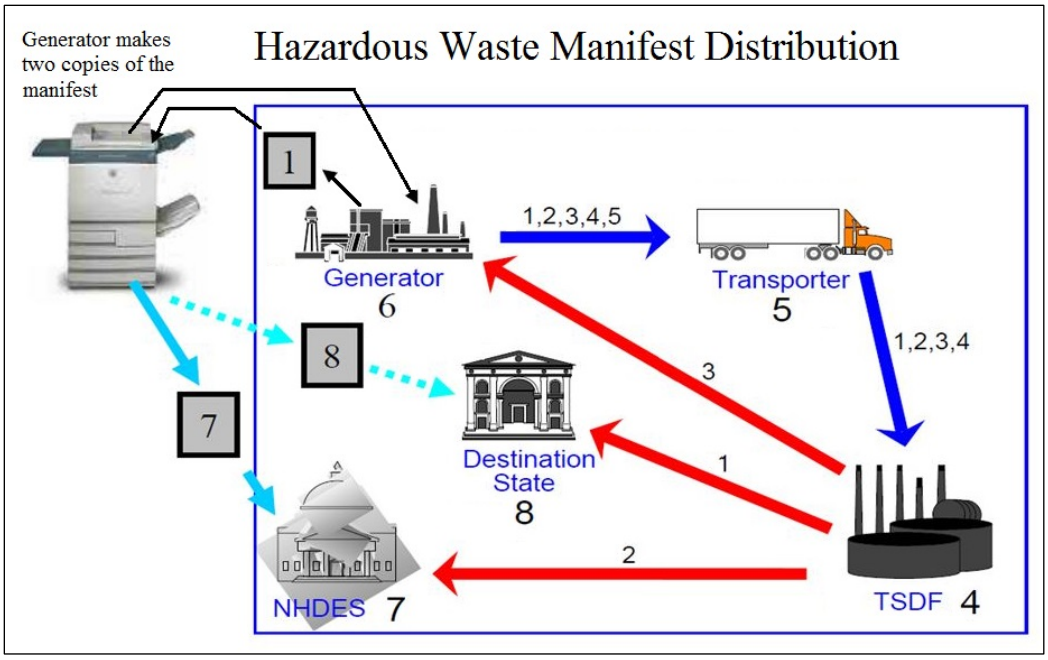


Figure 900 – 27: Hazardous Waste Manifest Distribution Chart

SECTION 909 – NHDOT AUTOMATIC FUELING SYSTEM

WELCOME TO AUTOMATED FUELING SYSTEM

This equipment will provide fuel for authorized users 24 hours a day, 7 days a week.

If you cannot obtain fuel please contact:
Site Manger at your current fueling location or call
Fuel Distribution: 7:00 a.m.- 3:00 p.m. at 271-2057
or TMC: 3:00 p.m.-7:00 a.m. at 271-6862

OPERATING INSTRUCTION

1. Approach the Automated Fueling Terminal. The display must read "**Welcome - Present Tag – Swipe Card**" to start a fueling transaction. If no message appears, and the system is not working between 7:00-4:00 please call 271-2057.
2. If the terminal appears to be operational place "**Vehicle Tag**" against the red circle on terminal. The display will respond with, "**Enter Pump Num**", enter desired pump number and push "**Ok**".
3. The display should respond with, "**Enter OdoMeter**", now enter odometer reading and push "**Ok**".
4. The display should respond with, "**Vehicle Acccepted Please Present Driver ID**", now slide your "**Driver Card**" or select the "**F3**" button and enter the six digit number printed on the bottom of your driver card. (A "**6**" should precede a five-digit card number or a "**60**" should precede a four-digit card number.)
5. Go to the pump you have selected, remove the hose nozzle, turn the reset handle to the "**ON**" position. Pump the required fuel, turn the reset handle to the "**OFF**" position and place the hose nozzle back in it's resting place. You should have had a successful fueling of your vehicle.

To prevent spills, DO NOT leave hoses unattended.

If you have problems, repeat steps 1 thru 5, or contact the Site Manager at your location.

If you need further assistance call the Fuel Distribution Section in Concord at 271-2057.

New Hampshire DOT
Department of Transportation

STATE OF NEW HAMPSHIRE
State Wide Automated Fuel Distribution

USER GUIDE

N.H. D.O.T.
Fuel Distribution Section
7 Hazen Drive – PO Box 483
Concord, NH 03301
(603) 271-2056

FUELING SITE LOCATION LIST

Sites Listed Below offer Unleaded & Diesel Fuel

ALTON: **Rte 28, 03809** - On Rte 28, on DOT 3 Lane, 1/4 mile north of the Alton Traffic Circle, at the NH DOT Shed

CHARLESTOWN: **187 Claremont Road, Rte 12, 03603** - On west side of NH Rte 12. 1/4 mile south of NH Rte 11, at the NH DOT Shed

COLUMBIA: **8 Grant Road, 03576** - On US Rte 3, 2 miles south of the Columbia/Colebrook town line at NH DOT shed

CONCORD HAZEN: **57 Hazen Drive, 03301** - Heading East or West on 393, off Exit 2, go left onto East Side Dr., right onto Hazen Dr. approximately 1/8 mile up on right

CONCORD CNG: **11 Stickney Avenue, 03301** - (NATURAL GAS ONLY) On Stickney Ave. in the north parking lot for the highway garage, near I 93 Exit 14

CONWAY: **608 Eaton Road (NH Rte. 153), 03818** - NH Rte 16 to Rte 153, approx 5 miles down on right, on Eaton Road at the NH DOT Shed

DERRY: **59 Kendall Pond Road, 03038** - Off Kendall Pond Road, via Gilcrest Rd. & NH Rte 102, near Exit 4, I 93, at NH DOT Shed

DOVER: **1 Indian Brook Drive, 03820** - At Exit 9, Spaulding Turnpike, Indian Brook Drive at the NH DOT Shed

DURHAM: **213 Main Street, 03824** - At the maintenance garage, off NH Rte 155A, 1/4 mile south of Rte 4 and Rte 155 intersection

ENFIELD: **8 Eastman Hill Road, 03748** - Off I 89 at Exit 16 first drive on right next to the northbound off-ramp, at NH DOT District #2 Headquarters

EPPING: **73 Old Hedding Road, 03042** - Off NH Rte 125 at the junction of Old Hedding Road next to NH State Police Troop A

GILFORD: **1 Lily Pond Road, 03249** - At the intersection of NH Rte 11 & Rte 11-C, at the east end of the by-pass near Lily Pond

GORHAM: **1 Morin Drive, 03581** - Off US Rte 2, 1 mile west of NH Rte 16 at the base of the hill at NH DOT Shed

HAMPTON: **Liberty Lane West, I-95, 03842** - Off I 95, 1/4 south of the Hampton Toll Booths on the south bound side

HILLSBOROUGH: **679 West Main Street, Rte 9, 03244** - On north side of NH Rte 9, 1/4 mile west of NH Rte 31 North at the NH DOT Shed

HOOKSETT: **36 Hackett Hill Road, 03054** - Off Exit #11 on the entrance road to Dist. #5 & Bureau of Turnpikes Hdqts, near Hooksett Toll Plaza

KINGSTON: **65 Mill Road, 03848** - From Rte 125 in Kingston, turn right on Rte 111, travel 1.3 miles, left onMill Road, first left into shed

LANCASTER: **647B Main Street, 03584** - On US Rte 3, 4 miles north of the town of Lancaster at the NH DOT DIST #1 Office

LINCOLN: **65 Old Airport Road, 03251** - At the end of Bern Dibner Road, behind Clark's Trained Bears, at the NH DOT Shed

LITTLETON: **201 Dells Road, 03561** - On Dell Rd., off US Rte 302, 1/10 mile east of I 93, Exit 42, behind N.G. Armory

MANCHESTER: NH Rte 101 east, 1/2 mile east of the intersection of I 93, or 1/2 mile west of Exit 1

MERRIMACK: **Route 3, 03054** - On NH Rte 3, 1/2 mile south of Exit 11 near Budweiser Plant

MILFORD: **33 Buxton Road, 03055** - At the end of Buxton Rd. off NH Rte 13, 1 mile north of the circle at the NH DOT Shed

MILTON: **245 White Mountain Highway, 03851** - On NH Rte 16, 1/10 mile south of the intersection of Rte. 16 and Rte. 75, at NH DOT Shed

NEW HAMPTON: **42 Rt. 104, 03256** - Off the north side of NH Rte 104, 1/4 mile east of I 93 Exit 23, at NH DOT Shed

NO. HAMPTON: **147 South Road, 03862** - On South Road, 1/4 south of NH Rte 101-D or 2 miles west of US Rte 1, at the NH DOT Satellite Garage

NO. HAVERHILL: **3375 Dartmouth College Hwy., 03774** - On NH Rte 10, 1.6 miles north of NH Rte 116, at NH DOT Shed 204

CENTER OSSIPEE (7 am - 3:30 pm): **15 Hodson Shore Road, 03814** - NH Rte 16 to Rte 25 E, take 1st left onto Hodson Shore Road, site is .2 miles on left

RINDGE: **1000 NH Route 119, 03461** - On north side of NH Rte 119, 2 miles west of US Rte 202 near Rindge/Fitzwilliam town line at NH DOT Shed

SUNAPEE: **8 Post Office Road, 03782** - On Post Office Rd., near inter of NH Rte 11 and 103 in the village of Wendell, 0.1 mile east of Newport town line, at NH DOT Shed

SWANZEY: **19 Base Hill Road, 03446** - On north side of Base Hill Rd, off NH Rte 10, 1.7 miles south of the inter. of Rte 101, at NH DOT Dist #4 Office

TAMWORTH: **1864 White Mountain Hwy (493 Rte. 16), 03581** - On NH Rte 16 1/2 mile north of the intersection of NH Rte 25, at NH State Police Troop E

THORNTON: **22 Laundromat Road, 03223** - On Laundromat Road, off Rte3, 1/2 mile north of I 93 Exit 29, NH DOT

TWIN MTN: **500 NH Rte. 302 West Carroll, 03595** - On US Rte 302, 1 mile west of the intersection of US Rte 3 across from State Police Troop F

WAKEFIELD: **1540 Wakefield Road (NH Rte. 153), 03830** - Rte 153, ½ mile sourth of Jct 153 & 109 at the NH DOT Shed

WARNER EXIT #7: **35 Warner Road, 03278** - Off NH Rte 103, 1/10 mile east of I 89 Exit 7, on Warner Road at NH DOT Shed

WENTWORTH: **465 East Side Drive, 03282** - Off NH Rte 25 at the Wentworth/Warren town line, 1/2 mile south on East Side Dr at NH DOT Shed

Sites Listed Below Offer Diesel Fuel Only

BEDFORD: **6 East Point Drive, Rte 3, 03110** - Rte 3, 1000 feet north of the Bedford/Merrimack town line on East Point Drive at the NH DOT Shed

GLEN: **88 NH Route 302, Bartlett, 03812** - On US Rte 302, 0.5 miles west of Jct. NH Rte 16

GROVETON: **116 Brown Road, 03582** - On Brown Road 0.6 miles from US Rte 3

NORTHWOOD: **1159 First NH Turnpike, 03261** - On the south side of Rte 4 approximately 1 mile east of the jct of Rte 107 N

STRAFFORD: **1101 Parker Moutain Road, 03884** - Approximately one mile north of Center Strafford on NH Rte 126

WARNER EXIT #9: **186 Rt. 103 West, 03278**, Exit #9 off I-89 to Rte #103, ½ mile to Dump Road on right at the NH DOT Shed