

8-25-2010

Construction Cost Models

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Recommended Citation

Dikeman, Barry, "Construction Cost Models" (2010). *Economics and Finance*. 8.
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CONSTRUCTION COST MODELS

Prepared by: The New England Environmental Finance Center
For the Maine Department of Transportation Office of Environmental Planning

November 1, 2010

The following are a series of cost estimate models similar in format to a typical engineer's estimate that were developed in support of our financial impact assessment report for LD 1725. The models use current material costs, labor costs, and equipment costs for the region to provide a comparative cost analysis of seven culvert replacement scenarios. The models provide information about what the cost impact of LD 1725 would be for typical culvert replacements in Maine. However, due to the inherent restrictions of the cost modeling framework we were not able to include the abundance of variables that would be present in a real world culvert replacement project. As such, the models are representative of very basic culvert replacement projects and may not reflect the tremendous variety and scale of variables that could be present in an actual culvert replacement project. For example, construction costs for culvert replacement in a rural setting versus an urban setting can vary by as much as 50% due to site-specific variables such as lane width, paving depth, traffic count and the presence of potentially conflicting underground utilities.

COST TABLE KEY:

- Description = description of item
- QTY = quantity of units
- Unit = unit of measurement for item
- Unit \$ = unit cost for item
- Total \$ = total cost for item [unit cost multiplied by quantity of units]
- \$/LF = total cost per lineal foot

Scenario #1: Replacement of 48" CMP in 10 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 12 feet. Depth measured from stream bottom to top of pavement of road = 8.0 feet. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes.

In-kind replacement of 48" CMP culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,000.00	\$1,000.00
2	Erosion Control	1	LS	\$500.00	\$500.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	80	LF	\$30.00	\$2,400.00
5	Remove Pavement	75	SY	\$5.00	\$375.00
6	Dam/Diversion of Stream	1	LS	\$750.00	\$750.00
7	Excavation/Removal of Existing Pipe	125	CY	\$15.00	\$1,875.00
8	Pipe Bedding	45	CY	\$20.00	\$900.00
9	Structural Backfill/Gravel Base	100	TN	\$18.00	\$1,800.00
10	48" CMP Culvert - Galvanized Metal	50	LF	\$75.00	\$3,750.00
11	Hot Mix Asphalt Pavement	20	TN	\$175.00	\$3,500.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Notes: Material used: CMP culvert

Project Total **\$18,650.00**
\$/LF **\$373.00**

Replacement of 48" CMP with ADS culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,000.00	\$1,000.00
2	Erosion Control	1	LS	\$500.00	\$500.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	80	LF	\$30.00	\$2,400.00
5	Remove Pavement	75	SY	\$5.00	\$375.00
6	Dam/Diversion of Stream	1	LS	\$750.00	\$750.00
7	Excavation/Removal of Existing Pipe	125	CY	\$15.00	\$1,875.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	100	TN	\$18.00	\$1,800.00
10	48" ADS/HDPE Culvert (smooth bore)	50	LF	\$70.00	\$3,500.00
11	Hot Mix Asphalt Pavement	18	TN	\$175.00	\$3,150.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Notes: Material used: HDPE culvert (corrugated on outside with smooth-bore).

Note: smoothbore HDPE culvert may not be allowed pending changes to LD 1725.

Project Total **\$18,500.00**
\$/LF **\$370.00**

Installation of 12'W x 6'H CMP arch culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,500.00	\$2,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	80	LF	\$30.00	\$2,400.00
5	Remove Pavement	80	SY	\$5.00	\$400.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	275	CY	\$15.00	\$4,125.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	195	TN	\$18.00	\$3,510.00
10	12' W x 6' H CMP Arch Culvert	50	LF	\$250.00	\$12,500.00
11	Hot Mix Asphalt Pavement	25	TN	\$175.00	\$4,375.00
12	Labor & Equipment to Assemble Plates	1	LS	\$2,000.00	\$2,000.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00
Notes: Material used: structural plate bottomless metal culvert. Traffic Control increases due to longer closure of the road				Project Total	\$47,760.00
				\$/LF	\$955.20

Installation of 12'W x 8'H 3-Sided concrete box culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,000.00	\$3,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	80	LF	\$30.00	\$2,400.00
5	Remove Pavement	80	SY	\$5.00	\$400.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	300	CY	\$15.00	\$4,500.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	195	TN	\$18.00	\$3,510.00
10	12' W x 8' H Open Bottomed Concrete Box Culvert	50	LF	\$700.00	\$35,000.00
11	Hot Mix Asphalt Pavement	25	TN	\$175.00	\$4,375.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
13	Crane Rental	1	LS	\$3,500.00	\$3,500.00
Notes: Material used: 3-sided (bottomless) precast concrete box culvert. Traffic Control increases due to longer closure of the road				Project Total	\$73,635.00
				\$/LF	\$1,472.70

Scenario #2: Replacement of 48" CMP in 10 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 12 feet. Depth measured from stream bottom to top of pavement of road = 14.0 feet. Note: this scenario is identical to scenario #1 with the exception of deeper fill. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes.

In-kind replacement of 48" CMP culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description		Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$4,000.00	\$4,000.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	150	LF	\$30.00	\$4,500.00
5	Remove Pavement	135	SY	\$5.00	\$675.00
6	Dam/Diversion of Stream	1	LS	\$750.00	\$750.00
7	Excavation/Removal of Existing Pipe	375	CY	\$15.00	\$5,625.00
8	Pipe Bedding	35	CY	\$30.00	\$1,050.00
9	Structural Backfill/Gravel Base	450	TN	\$18.00	\$8,100.00
10	48" CMP Culvert - Galvanized Metal	60	LF	\$155.00	\$9,300.00
11	Hot Mix Asphalt Pavement	50	TN	\$175.00	\$8,750.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Note: Will require shoring (trench boxes, etc.) to allow for safe excavation at this depth which will significantly slow the rate of production.

Project Total **\$44,800.00**
\$/LF **\$896.00**

Installation of 12'W x 6'H CMP arch culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$4,000.00	\$4,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	150	LF	\$30.00	\$4,500.00
5	Remove Pavement	165	SY	\$5.00	\$825.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	925	CY	\$15.00	\$13,875.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	1120	TN	\$18.00	\$20,160.00
10	12' W x 6' H CMP Structural Plate Arch Culvert	60	LF	\$250.00	\$15,000.00
11	Hot Mix Asphalt Pavement	55	TN	\$175.00	\$9,625.00
12	Labor & Equipment to Assemble Plates	1	LS	\$2,000.00	\$2,000.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Trench box type shoring will not work in this case due to width of excavation. Contractor will likely open-cut the excavation as structural shoring would be cost prohibitive in this application.

Project Total **\$86,935.00**
\$/LF **\$1,738.70**

Installation of 12'W x 8'H 3-Sided concrete box culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$4,000.00	\$4,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	150	LF	\$30.00	\$4,500.00
5	Remove Pavement	165	SY	\$5.00	\$825.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	925	CY	\$15.00	\$13,875.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	1100	TN	\$18.00	\$19,800.00
10	12' W x 8' H Open Bottomed Concrete Box Culvert	60	LF	\$700.00	\$42,000.00
11	Hot Mix Asphalt Pavement	55	TN	\$175.00	\$9,625.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
13	Crane Rental	1	LS	\$3,500.00	\$3,500.00

Notes: Trench box type shoring will not work in this case due to width of excavation. Contractor will likely open-cut the excavation as structural shoring would be cost prohibitive in this application.

Project Total **\$115,075.00**
\$/LF **\$2,301.50**

Sliplining of 48" CMP culvert in 10 foot channel (12 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$500.00	\$500.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	0	SY	\$40.00	\$0.00
4	Remove & Reset Guardrail	0	LF	\$30.00	\$0.00
5	Remove Pavement	0	SY	\$5.00	\$0.00
6	Dam/Diversion of Stream	1	LS	\$750.00	\$750.00
7	Excavation/Removal of Existing Pipe	0	CY	\$15.00	\$0.00
8	Pipe Bedding	0	CY	\$20.00	\$0.00
9	Structural Backfill/Gravel Base	0	TN	\$15.00	\$0.00
10	42" HDPE Snap-Tite Pipe with Annular Grout	60	LF	\$300.00	\$18,000.00
11	Hot Mix Asphalt Pavement	0	TN	\$175.00	\$0.00
12	Structural Backfill/Gravel Base	1	LS	\$500.00	\$500.00

Notes: Sliplining can offer a significant savings over in-kind replacement in settings where access to the pipe is limited or difficult such as: high traffic locations, underground utility conflicts or excessive depth of fill. **Note: sliplining would be disallowed under LD 1725.**

Project Total **\$20,500.00**
\$/LF **\$410.00**

Scenario #3: Replacement of 48" CMP in 7.5 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 9 feet. Depth measured from stream bottom to top of pavement of road = 9.0 feet. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes. Replacement construction at this depth may require safety shoring.

In-kind replacement of 48" CMP culvert in 7.5 foot channel (9 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,000.00	\$1,000.00
2	Erosion Control	1	LS	\$500.00	\$500.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	80	LF	\$30.00	\$2,400.00
5	Remove Pavement	75	SY	\$5.00	\$375.00
6	Dam/Diversion of Stream	1	LS	\$750.00	\$750.00
7	Excavation/Removal of Existing Pipe	125	CY	\$15.00	\$1,875.00
8	Pipe Bedding	45	CY	\$20.00	\$900.00
9	Structural Backfill/Gravel Base	100	TN	\$18.00	\$1,800.00
10	48" CMP Culvert - Galvanized Metal	50	LF	\$75.00	\$3,750.00
11	Hot Mix Asphalt Pavement	20	TN	\$175.00	\$3,500.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Note: Material used: CMP culvert

Project Total **\$18,650.00**
\$/LF **\$373.00**

Replacement of 48" CMP with 112" x 75" CMP Galvanized Arch Pipe in 7.5 foot channel (9 foot @ 1.2 BF)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,250.00	\$1,250.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	110	SY	\$5.00	\$550.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	275	CY	\$15.00	\$4,125.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	220	TN	\$18.00	\$3,960.00
10	112" x 75" CMP Galvanized Arch (Elliptical) culvert	50	LF	\$140.00	\$7,000.00
11	Hot Mix Asphalt Pavement	75	TN	\$175.00	\$13,125.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Notes: Material used: CMP elliptical arch culvert

Project Total **\$39,060.00**
\$/LF **\$781.20**

Installation of 10'W x 5'-3"H CMP arch culvert in 7.5 foot channel (9 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,500.00	\$2,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	110	SY	\$5.00	\$550.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	275	CY	\$15.00	\$4,125.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	195	TN	\$18.00	\$3,510.00
10	10' W x 5'3" H CMP Structural Plate Arch Culvert	50	LF	\$225.00	\$11,250.00
11	Stream Bottom Gravel	40	TN	\$25.00	\$1,000.00
12	Hot Mix Asphalt Pavement	75	TN	\$175.00	\$13,125.00
13	Labor & Equipment to Assemble Plates	1	LS	\$2,000.00	\$2,000.00
14	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Material used: structural plate bottomless metal culvert. Traffic Control increases due to longer closure of the road.

Project Total **\$58,010.00**
\$/LF **\$1,160.20**

Installation of 10'W x 6'H 3-Sided concrete box culvert in 7 foot channel (9 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,000.00	\$3,000.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	110	SY	\$5.00	\$550.00
6	Dam/Diversion of Stream	1	LS	\$1,500.00	\$1,500.00
7	Excavation/Removal of Existing Pipe	300	CY	\$15.00	\$4,500.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	195	TN	\$15.00	\$2,925.00
10	10' W x 6' H Open Bottomed Concrete Box Culvert	50	LF	\$500.00	\$25,000.00
11	Stream Bottom Gravel	40	TN	\$25.00	\$1,000.00
12	Hot Mix Asphalt Pavement	75	TN	\$175.00	\$13,125.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
14	Crane Rental	1	LS	\$3,500.00	\$3,500.00

Notes: Traffic Control increases due to longer closure of the road

Project Total **\$73,050.00**
\$/LF **\$1,461.00**

Scenario #4: Replacement of 30" CMP in 6.75 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 8 feet. Depth measured from stream bottom to top of pavement of road = 6.0 feet. **Note: cost evaluation of a 3-side concrete box culvert was not performed for this scenario.** Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes.

In-kind replacement of 30" CMP culvert in 6.75 foot channel (8 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$500.00	\$500.00
2	Erosion Control	1	LS	\$500.00	\$500.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	45	SY	\$5.00	\$225.00
6	Dam/Diversion of Stream	1	LS	\$500.00	\$500.00
7	Excavation/Removal of Existing Pipe	95	CY	\$15.00	\$1,425.00
8	Pipe Bedding	20	CY	\$20.00	\$400.00
9	Structural Backfill/Gravel Base	70	TN	\$18.00	\$1,260.00
10	30" CMP Culvert - Galvanized Metal	50	LF	\$35.00	\$1,750.00
11	Hot Mix Asphalt Pavement	15	TN	\$175.00	\$2,625.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Note: Towns would likely not use guardrail in this situation due to shallow fill. MaineDOT may be required to use guardrail so it has been included for comparison.

Project Total **\$13,485.00**
\$/LF **\$269.70**

Installation of 95" x 67" CMP Galvanized Arch Pipe in 6.75 foot channel (8 foot @ 1.2 BF)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,250.00	\$1,250.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	30	SY	\$40.00	\$1,200.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	575	SY	\$5.00	\$2,875.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	135	CY	\$15.00	\$2,025.00
8	Pipe Bedding	35	CY	\$30.00	\$1,050.00
9	Structural Backfill/Gravel Base	250	TN	\$18.00	\$4,500.00
10	95" x 67" CMP Galvanized Arch (Elliptical) culvert	60	LF	\$120.00	\$7,200.00
11	Hot Mix Asphalt Pavement	125	TN	\$175.00	\$21,875.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Notes: Pipe will be imbedded by 20% so actual height will be reduced from 67" to 54" however, the depth of cover will need to be increased thus lengthening pipe and resulting in substantial reconstruction of road including: increasing fill and pavement.

Project Total **\$48,475.00**
\$/LF **\$969.50**

Installation of 8'W x 4'-2"H CMP arch culvert in 6.75 foot channel (8 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,500.00	\$2,500.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	40	SY	\$40.00	\$1,600.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	75	SY	\$5.00	\$375.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	175	CY	\$15.00	\$2,625.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	105	TN	\$18.00	\$1,890.00
10	Structural Plate Arch CulvertArch Culvert	50	LF	\$195.00	\$9,750.00
11	Stream Bottom Gravel	25	TN	\$25.00	\$625.00
12	Hot Mix Asphalt Pavement	20	TN	\$175.00	\$3,500.00
13	Labor & Equipment to Assemble Plates	1	LS	\$1,500.00	\$1,500.00
14	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Material used: structural plate bottomless metal culvert. Traffic Control increases due to longer closure of the road.

Project Total \$42,865.00
\$/LF \$857.30

Scenario #5: Replacement of 72" CMP in 14 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 16 feet. Depth measured from stream bottom to top of pavement of road = 10.0 feet. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes. Replacement construction at this depth may require safety shoring.

In-kind replacement of 72" CMP culvert in 14 foot channel (+/- 16 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,000.00	\$2,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	25	SY	\$40.00	\$1,000.00
4	Remove & Reset Guardrail	90	LF	\$30.00	\$2,700.00
5	Remove Pavement	115	SY	\$5.00	\$575.00
6	Dam/Diversion of Stream	1	LS	\$1,000.00	\$1,000.00
7	Excavation/Removal of Existing Pipe	400	CY	\$15.00	\$6,000.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	450	TN	\$18.00	\$8,100.00
10	72" CMP Culvert - Galvanized Metal	50	LF	\$105.00	\$5,250.00
11	Hot Mix Asphalt Pavement	35	TN	\$175.00	\$6,125.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Note: A 72" culvert will require a minimum 10 foot wide trench to safely construct.

Project Total **\$35,600.00**
\$/LF **\$712.00**

Replacement of 72" CMP culvert with twin HDPE pipes in 14 foot channel (16 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,000.00	\$1,000.00
2	Erosion Control	1	LS	\$750.00	\$750.00
3	RipRap	20	SY	\$40.00	\$800.00
4	Remove & Reset Guardrail	90	LF	\$30.00	\$2,700.00
5	Remove Pavement	115	SY	\$5.00	\$575.00
6	Dam/Diversion of Stream	1	LS	\$1,000.00	\$1,000.00
7	Excavation/Removal of Existing Pipe	400	CY	\$15.00	\$6,000.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	475	TN	\$18.00	\$8,550.00
10	36" ADS/HDPE Culvert (smooth bore) multiple	100	LF	\$45.00	\$4,500.00
11	Hot Mix Asphalt Pavement	35	TN	\$175.00	\$6,125.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Notes: Installation of twin 36 inch HDPE culverts. **Note: although the installation of multiple culverts is currently a fairly common practice it would not be allowed under LD 1725 and is shown here for comparison purposes only.**

Project Total **\$33,850.00**
\$/LF **\$677.00**

Installation of 16'W x 6'H CMP arch culvert in 14 foot channel (16 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	125	SY	\$5.00	\$625.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	250	CY	\$15.00	\$3,750.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	350	TN	\$18.00	\$6,300.00
10	16 W x6' H CMP Structural Plate Arch Culvert	50	LF	\$400.00	\$20,000.00
11	Hot Mix Asphalt Pavement	40	TN	\$175.00	\$7,000.00
12	Labor & Equipment to Assemble Culvert	1	LS	\$2,000.00	\$2,000.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Traffic Control increases due to longer closure of the road

Project Total **\$63,925.00**
\$/LF **\$1,278.50**

Installation of 16'W x 6'H 3-Sided concrete box culvert in 14 foot channel (16 foot @ 1.2 bankfull)

Item	Description	Quantity	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	95	SY	\$5.00	\$475.00
6	Dam/Diversion of Stream	1	LS	\$1,750.00	\$1,750.00
7	Excavation/Removal of Existing Pipe	350	CY	\$15.00	\$5,250.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	275	TN	\$18.00	\$4,950.00
10	16' W x 6' H Open Bottomed Concrete Box Culvert	50	LF	\$775.00	\$38,750.00
11	Stream Bottom Gravel	70	TN	\$25.00	\$1,750.00
12	Hot Mix Asphalt Pavement	38	TN	\$175.00	\$6,650.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
14	Crane Rental	1	LS	\$3,500.00	\$3,500.00

Notes:

Project Total **\$85,575.00**
\$/LF **\$1,711.50**

Scenario #6: Replacement of 96" CMP in 15 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 18 feet. Depth measured from stream bottom to top of pavement of road = 10.0 feet. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes. Replacement construction at this depth may require safety shoring.

In-kind replacement of 96" CMP culvert in 15 foot channel (+/- 18 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,500.00	\$1,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	35	SY	\$40.00	\$1,400.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	140	SY	\$5.00	\$700.00
6	Dam/Diversion of Stream	1	LS	\$2,000.00	\$2,000.00
7	Excavation/Removal of Existing Pipe	535	CY	\$15.00	\$8,025.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	575	TN	\$18.00	\$10,350.00
10	96" CMP Culvert - Galvanized Metal	50	LF	\$120.00	\$6,000.00
11	Hot Mix Asphalt Pavement	50	TN	\$175.00	\$8,750.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Note: A 96" culvert will require a minimum 12 foot wide trench to safely construct.

Project Total **\$44,575.00**
\$/LF **\$891.50**

Replacement of 96" CMP culvert with twin 48" ADS/HDPE pipes in 15 foot channel (18 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$1,500.00	\$1,500.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	35	SY	\$40.00	\$1,400.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	140	SY	\$5.00	\$700.00
6	Dam/Diversion of Stream	1	LS	\$2,000.00	\$2,000.00
7	Excavation/Removal of Existing Pipe	550	CY	\$15.00	\$8,250.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	625	TN	\$18.00	\$11,250.00
10	48" ADS/HDPE Culvert (smooth bore) multiple	100	LF	\$70.00	\$7,000.00
11	Hot Mix Asphalt Pavement	50	TN	\$175.00	\$8,750.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Notes: Installation of twin 48 inch HDPE culverts. **Note: although the installation of multiple culverts is currently a fairly common practice it would not be allowed under LD 1725 and is shown here for comparison purposes only.**

Project Total **\$46,700.00**
\$/LF **\$934.00**

Installation of 18"W x 8'H CMP arch culvert in 15 foot channel (18 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,500.00	\$1,500.00
3	RipRap	65	SY	\$40.00	\$2,600.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	195	SY	\$5.00	\$975.00
6	Dam/Diversion of Stream	1	LS	\$3,500.00	\$3,500.00
7	Excavation/Removal of Existing Pipe	725	CY	\$15.00	\$10,875.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	700	TN	\$18.00	\$12,600.00
10	18'W x8' H CMP Structural Plate Arch Culvert	50	LF	\$450.00	\$22,500.00
11	Stream Bottom Gravel	85	TN	\$25.00	\$2,125.00
12	Hot Mix Asphalt Pavement	65	TN	\$175.00	\$11,375.00
13	Labor & Equipment to Assemble Plates	1	LS	\$2,000.00	\$2,000.00
14	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Material used: structural plate bottomless metal culvert. Traffic Control increases due to longer closure of the road.

Project Total **\$89,550.00**
\$/LF **\$1,791.00**

Installation of 18'W x 8'H 3-Sided concrete box culvert in 15 foot channel (18 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,500.00	\$1,500.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	195	SY	\$5.00	\$975.00
6	Dam/Diversion of Stream	1	LS	\$3,500.00	\$3,500.00
7	Excavation/Removal of Existing Pipe	725	CY	\$15.00	\$10,875.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	575	TN	\$18.00	\$10,350.00
10	18' W x 8' H Open Bottomed Concrete Box Culvert	50	LF	\$1,050.00	\$52,500.00
11	Stream Bottom Gravel	85	TN	\$30.00	\$2,550.00
12	Hot Mix Asphalt Pavement	65	TN	\$175.00	\$11,375.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
14	Crane Rental	1	LS	\$3,500.00	\$3,500.00

Notes:

Project Total **\$118,625.00**
\$/LF **\$2,372.50**

Scenario #7: Replacement of 120" CMP in 17 foot channel. Under LD 1725 the 1.2X bankfull measurement would be 20 feet. Depth measured from stream bottom to top of pavement of road = 13.0 feet. Culverts with spans/diameters greater than 96" present construction challenges that prevent many municipalities from self-performing replacement. Site specific assumptions: 2 lane paved non-arterial feeder road (rural or suburban) with low daily traffic volumes and several possible detour routes. Replacement construction at this depth may require safety shoring.

In-kind replacement of 120" CMP culvert in 17 foot channel (+/- 20 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,000.00	\$2,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	150	SY	\$5.00	\$750.00
6	Dam/Diversion of Stream	1	LS	\$2,000.00	\$2,000.00
7	Excavation/Removal of Existing Pipe	550	CY	\$15.00	\$8,250.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	700	TN	\$18.00	\$12,600.00
10	120" CMP Culvert - Galvanized Metal	50	LF	\$215.00	\$10,750.00
11	Hot Mix Asphalt Pavement	50	TN	\$175.00	\$8,750.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$1,000.00	\$1,000.00

Note: A 120" culvert will require a minimum 14 foot wide trench to safely construct.

Project Total **\$53,450.00**
\$/LF **\$1,069.00**

Replacement of 120" CMP with twin 60" HDPE culvert in 17 foot channel (20 foot @ 1.2 bankfull)

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$2,000.00	\$2,000.00
2	Erosion Control	1	LS	\$1,000.00	\$1,000.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	150	SY	\$5.00	\$750.00
6	Dam/Diversion of Stream	1	LS	\$2,000.00	\$2,000.00
7	Excavation/Removal of Existing Pipe	550	CY	\$15.00	\$8,250.00
8	Pipe Bedding	45	CY	\$30.00	\$1,350.00
9	Structural Backfill/Gravel Base	750	TN	\$18.00	\$13,500.00
10	60" ADS/HDPE Culvert (smooth bore) multiple	120	LF	\$90.00	\$10,800.00
11	Hot Mix Asphalt Pavement	50	TN	\$175.00	\$8,750.00
12	Mobilization & Miscellaneous Cleanup	1	LS	\$500.00	\$500.00

Notes: Installation of twin 48 inch HDPE culverts. **Note: although the installation of multiple culverts is currently a fairly common practice it would not be allowed under LD 1725 and is shown here for comparison purposes only.**

Project Total **\$53,900.00**
\$/LF **\$1,078.00**

Installation of 20'W x 6'H CMP arch culvert to meet the 1.2BF of a 17'W channel.

Item	Description	QTY	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,500.00	\$1,500.00
3	RipRap	75	SY	\$40.00	\$3,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	185	SY	\$5.00	\$925.00
6	Dam/Diversion of Stream	1	LS	\$3,000.00	\$3,000.00
7	Excavation/Removal of Existing Pipe	850	CY	\$15.00	\$12,750.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	800	TN	\$18.00	\$14,400.00
10	20'W x6' H CMP Structural Plate Arch Culvert	50	LF	\$575.00	\$28,750.00
11	Stream Bottom Gravel	85	TN	\$25.00	\$2,125.00
12	Hot Mix Asphalt Pavement	65	TN	\$175.00	\$11,375.00
13	Labor & Equipment to Assemble Plates	1	LS	\$2,000.00	\$2,000.00
14	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00

Notes: Material used: structural plate bottomless metal culvert. Traffic Control increases due to longer closure of the road

Project Total \$/LF **\$99,325.00**
\$1,986.50

Installation of 20'W x 10'H 3-Sided concrete box culvert to meet the 1.2BF of a 17'W channel.

Item	Description	Quantity	Unit	Unit \$	Total \$
1	Traffic Control	1	LS	\$3,500.00	\$3,500.00
2	Erosion Control	1	LS	\$1,500.00	\$1,500.00
3	RipRap	50	SY	\$40.00	\$2,000.00
4	Remove & Reset Guardrail	100	LF	\$30.00	\$3,000.00
5	Remove Pavement	185	SY	\$5.00	\$925.00
6	Dam/Diversion of Stream	1	LS	\$3,000.00	\$3,000.00
7	Excavation/Removal of Existing Pipe	850	CY	\$15.00	\$12,750.00
8	Footings	100	LF	\$115.00	\$11,500.00
9	Structural Backfill/Gravel Base	650	TN	\$18.00	\$11,700.00
10	20' W x 10' H Open Bottomed Concrete Box Culvert	50	LF	\$1,200.00	\$60,000.00
11	Hot Mix Asphalt Pavement	65	TN	\$175.00	\$11,375.00
12	Stream Bottom Gravel	85	TN	\$30.00	\$2,550.00
13	Mobilization & Miscellaneous Cleanup	1	LS	\$1,500.00	\$1,500.00
14	Crane Rental	1	LS	\$3,500.00	\$3,500.00

Notes:

Project Total \$/LF **\$128,800.00**
\$2,576.00

Sources

Contech Construction Products, Inc. - 2010 Material Prices: CMP Culverts and Structural Metal Plate Culverts

<http://www.contech-cpi.com/Products/Pipe.aspx>

WH Shurtleff & Co. - 2010 Material Prices: CMP Culverts, Structural Metal Plate Culverts and HDPE Culverts

<http://whshurtleff.com/>

Broadcove Associates - 2010 Material and Labor Prices: HDPE Sliplining

http://broadcoveassociates.com/culvert_lining.html

American Concrete Industries - 2010 Material Prices: Precast Concrete Box Culvert

http://www.americanconcrete.com/commercial/box_culverts/box-culverts.htm

Maine Department of Transportation - 2008-2010 Bid Tabulations: Labor Rates, Equipment Rates, Material Prices

<http://www.state.me.us/mdot/comprehensive-list-projects/bidtabarchive.php>

RS Means Reed Construction Data - 2008 -2010 Maine Archives: Labor Rates, Equipment Rates, Material Prices

<http://rsmeans.reedconstructiondata.com/>