R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505 September 14, 2007
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

MEMORANDUM 38:

TUNNEL ROAD CONSTRUCTION COST

CODES: **CALIFORNIA BUILDING CODE (CBC) 2007**
IBC 2006
AMERICAN ASSOCIATION OF PUBLIC WORKS CONSTRUCTION MANUAL (AAPWA); GREENBOOK

SCOPE OF WORK:

1. **CIVIL ENGR DESIGN**
2. **PROJECT LOCATION MAP**
3. **ROAD DESIGN**
4. **COST ESTIMATE BASED ON MEMORANDUM 23 DESIGN**

GEOTECHNICAL ENGINEER OF RECORD:

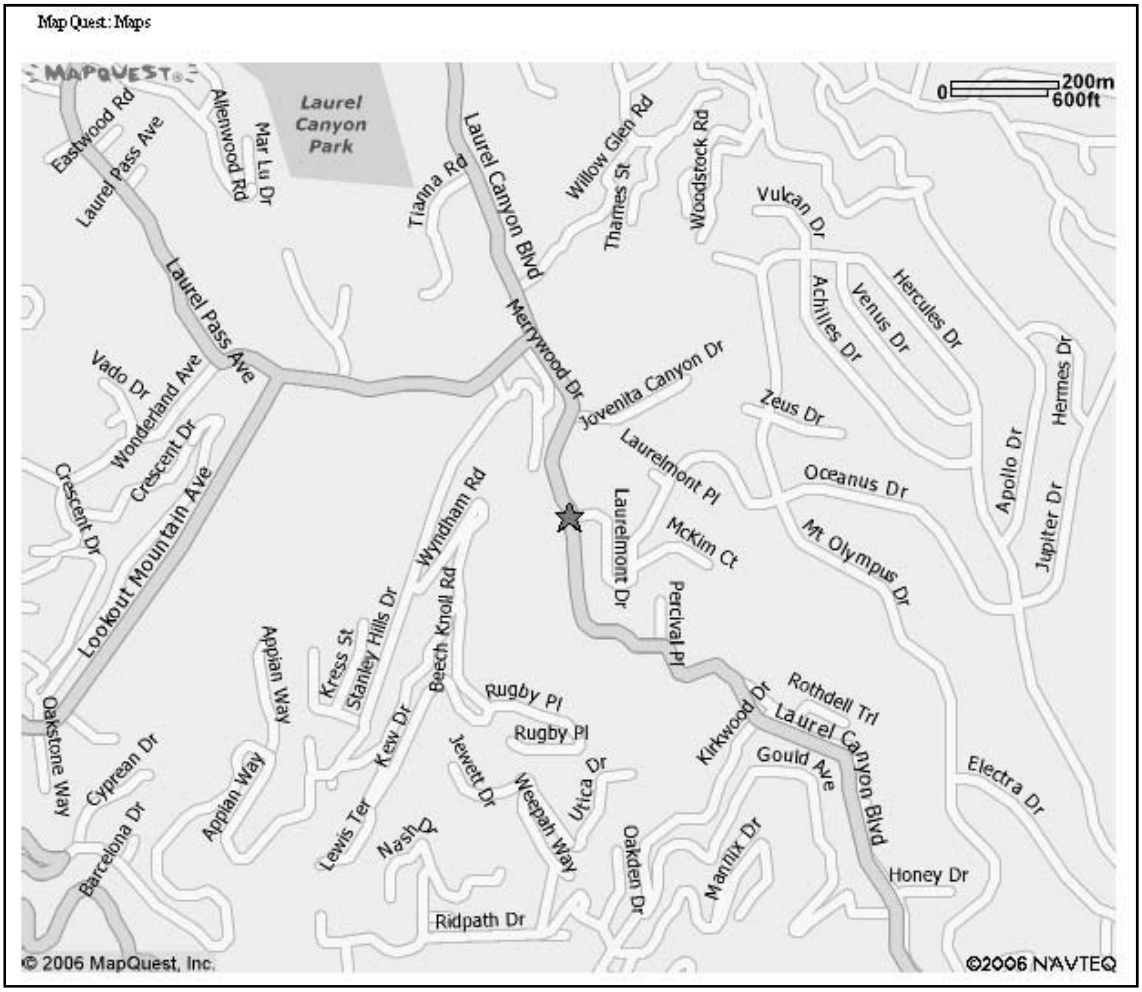
EARTH SYSTEMS SOUTHERN CALIFORNIA

1. CIVIL ENGINEERING ANALYSIS PROCEDURE:

The Tunnel Design consists of a boxed cut and cover structure comprising two reinforced masonry walls with a 12” thick spancrete top slab. The road is 6” reinforced concrete.

R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505 September 14, 2007
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

2. PROJECT LOCATION MAP



R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

3. COST BREAKDOWN:

I. ROAD DESIGN PARAMETERS

LENGTH = 1500 FT
WIDTH = 20 FT
HEIGHT = 14 FT (clear)

AREA OF ROADWAY = 1500 x 20 = 30,000 sq. ft.

II. SOLDIER PILES

Upslope Retaining Wall
H = 15′ + 10′ + 2′ = 27′ avg hgt
[average height retaining wall with 10′ minimum embedment into rock; 2′ for GB; 15′ avg height above grade]

Downslope Retaining Wall
H = 14′ + 10′ = 24′ → use 26′ avg. hgt.

Pile spacing = 10′ oc [based on geotechnical requirements]

Soldier Pile W12x79 ***[based on previous design work with 28′ deep piles for hillside construction]***

N = number of piles = 1500/10 = 150 piles per wall
N = 2 x 150 = 300 piles

L = Total length of Piles = 300 x 27′ = 8,100 LF

WGT = Total Steel Wgt of Piles = 8,100 x 79 = 639,900#

Material Cost = $0.40/# x 639,900 = $255,960 -> $260,000

R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505 September 14, 2007
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

Erection and Labor = $0.80/# x 640,000 = $512,000

Total Steel Pile Erection/Placement = $772,000

Steel Cost/Pile = $772,000/300 = $2,573/pile
Steel Cost/LF = $772,000/8100 = $95/Ft

III. CONCRETE VOLUME

24" diameter piles filled with 3,000 psi concrete

Area of Pile = πr^2 = π x 1^2 = 3.142 sq. ft./pile

Volume of Piles = 3.142 x 27' = 84.8 ft3/pile
= 84.8/27 = 3.142 cyd/pile

Concrete cost = $120 + $20 + $10 = $150/cyd

Total Concrete Volume = 3.142 cyd/pile x 300 piles
= 942.6 cyd [105 Trucks]
Total Concrete Cost = $150/cyd x 942.6
Total Concrete Cost = $141,390 → $145,000

IV. MASONRY WALLS

Wall Area = 2 x 15' x 1500' = 45,000 sf
Units = 45,000 x 1.15 = 51,750 units
12" CMU, 3,000 psi block
Masonry Block = $5/unit
Masonry Block cost = $3/unit x 51,750 = $155,250

Labor = $4/sf x 45,000 = $180,000
Grout = $2/sf x 45,000 = $ 90,000
Rebar = $3/sq x 45,000 = $135,000

Total Masonry Cost = $ 560,250

R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505 September 14, 2007
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

V. DIRT/EXCAVATION

CUT VOLUME = AREA x Length

Cut Area = bh = 22′ x 15′ = 330 sf
Length = 1500 LF

Volume = 1500 x 330 x 1.1 = 544,500cf → use 545,000 cf
Volume = 545,000/27 = 20,185 cyd

Trucks = 20,185/18 = 1,122 Trucks
[use double trailer haulers]

Cost/Truck = $200/truck

Dirt Moving (export) = 1,122Trucks x $200/truck = $224,400

EXPORT = $224,400 → use $225,000

VI. ROAD PAVEMENT CROSS SECTION

AREA of Road = 30,000 sf

Base cost for Standard City of LA x-section
[based on 4″ AC over 8″ base]

$9/sf

Road cost = 30,000 x $9/sf = $270,000

Spancrete TOP

30,000 sf x $10/sf = $300,000

R.C.E. # 40833, SE # 4391, GENERAL CONTRACTOR # B 555505 September 14, 2007
630 N. Rosemead Blvd., Suite 200, Pasadena, CA 91107
http://www.khatrinternational.com/ , dkhatri@aol.com
Tel. (626) 351-4830 Fax (626) 351-4339

VII. CRANE AND ONSITE EQUIPMENT

The onsite equipment needed for this operation will be:

(1) Gradall
(2) 60 Ton Crane
(3) Onsite Trailer
(4) Office
(5) Telephone and Temporary Power
(6) Toilet facilities
(7) Water

The timeline for this road construction is approximately 18 months.
Cost = $14,000/month

Cost = $14,000 x 18 = $252,000

VIII. GENERAL CONDITIONS

Standard GC for this project are charged at 2% of the base cost. This includes cost for insurance, worker compensation, builder risk coverage, and construction bonds.

IX. OVERHEAD & PROFIT

Khatri International's O&P margin is 11% of the base bid.

X. TOTAL ESTIMATE

TOTAL ROAD CONSTRUCTION = $ 3,152,000