WHAT YOU SHOULD KNOW ABOUT CONTROLLED BLASTING

LAS VIRGENES MUNICIPAL WATER DISTRICT WATER STORAGE TANK PROJECT

By: Gordon F. Revey, P.Eng.
MEETING OUTLINE AND SCOPE

- Description of Project
- Blasting Locations
- Excavation Methods
- Review Modern Blasting Technology
- Explosives Security, Regulations and Oversight
- Blast Effects - Vibration and Noise
- Controlling Blast Effects
- Questions and Answers
PROJECT DESCRIPTION

Brief project description (If not already done by others)
WATER TANK WORK SITE MAP

Alternative A
Tank Location 16,470 CY

Alternative C
Tank Location 4,808 CY

Potential Rock Excavation for Access Road
817 ft
1,160 ft

Scale
0 100 200 300 400
Excavation Methods

Mechanical methods were considered but rock at site is too hard.
Project Management Practices

- Evaluate Area Property
  * Pre-construction Inspections
- Apply Blasting Controls
  * Charge Weight Limits
  * Noise Control Measures
- Public Communication
  * Project Phone Number
    (XXX) XXX-XXX
  * Open Meetings
- Government Approvals
- Perform Work Safely
- Monitor Actual Blast Effects
Modern Explosives Technology

Modern explosives are much safer than the old "Dynamite and fuses" seen in Hollywood Movies

Blast effects are also much different than the fireball special effects seen in movies like Diehard
Blasting Program Requirements

- Only Proven and Safe Methods will be Used
- Prevent Damage to all Property and Facilities
- Minimize Impacts on Neighbors and Environment
- Ensure Explosives Security
- Licensed Blasters and Trained Inspectors will Oversee all Blasting Work
Explosives Delivery, Transport & Storage Systems

- No Overnight Storage Allowed
- ATF Rules
- DOT Rules
- OSHA Rules
- Inspector and Consultant Oversight
Careful Oversight

Trained Inspectors will Oversee Blasting Work and Explosive Handling Practices
Blast Energy Reduces Rapidly with Distance

Vibration reduces rapidly with distance

<table>
<thead>
<tr>
<th>Distance (feet)</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>400</th>
<th>800</th>
<th>1600</th>
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</thead>
<tbody>
<tr>
<td>Energy (ips)</td>
<td>2.5</td>
<td>0.8</td>
<td>0.25</td>
<td>0.1</td>
<td>0.03</td>
<td>0.009</td>
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Blast Charge

Body Wave

Surface Wave

Blast Charge

Body Wave
Comparison Between Earthquake and Controlled Blast Vibrations

Earthquake Movement is over 3,000 times greater!
Motion of Blasts Compared to that Caused by Normal Human and Environmental Forces

Data Sources: Oriard, 1999; Stagg et al, 198; and BSI Surveys, 2001
How Blasters Determine Charge Size to Control Vibration

For PPV Less than 0.5 in/s
Minimum Scaled Distance = 65

\[ W = \left( \frac{500}{65} \right)^2 = 59 \text{ pounds} \]

Blast uses many small charges timed to fire at separate times.
Charges are fired separately to reduce vibration

Many Holes are Drilled

Blast is a series of many time-delayed charges

Detonators are hooked up to create separate firing times for all charges

Holes are charged with many relatively small charges
In a Controlled Test, Buried Raw Eggs and Light bulbs Survive Vibration 10 times greater than that allowed for this work (5.0 versus 0.5 in/s)

Egg and light bulb buried next to a buried 11-lb charge survived motion 20 times higher than intensity of motion predicted at Properties closest to LVMWD Blasts
CONFINED BLASTS

1) CRUSHED STONE STEMMING IS PLACED OVER EXPLOSIVE CHARGES TO CONTROL NOISE

2) BLAST MATS ARE PLACED ON TOP OF BLAST AREAS
SUMMARY: WHY CONTROLLED BLASTS DO NOT CAUSE DAMAGE

• Energy from many small time-delayed charges reduces rapidly with distance.

• Motion caused by controlled blasting is 1000's of times less than that caused by earthquakes.

• Everyday environmental and human activities create more stress in structure than that caused by controlled blasts.
Human Response to Vibration

After Wiss and Parmalee (1974)

- Strongly perceptible
- ISO reduced comfort
- Severe
- Distinctly perceptible
- Barely perceptible

After USBM RI 8507 (1980)

LVMWD RANGE
WATER TANK PROJECT BLASTING SCHEDULE AND WARNING SIGNALS

- One blasts per day, each lasting less than one second. Temporary road closures of XXX Rd will occur while blasting; time will be kept as short as possible
- No blasting on Saturdays, Sundays or Holidays
- Blasting will occur begin XXXX and end in late fall, 2011.
- Nearby residents may hear warning sirens shown below

<table>
<thead>
<tr>
<th>HORNSIGNALS FOR BLASTING</th>
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<tbody>
<tr>
<td>FIVE MINUTE WARNING:</td>
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<tr>
<td>Long series of siren wails</td>
</tr>
<tr>
<td>ONE MINUTE WARNING:</td>
</tr>
<tr>
<td>A series of short siren yelps</td>
</tr>
<tr>
<td>ALL CLEAR SIGNAL:</td>
</tr>
<tr>
<td>A single one-minute siren signal</td>
</tr>
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Noise & Vibration Monitoring
PROPERTY CONDITION SURVEYS

Owners of properties located within 1000 feet of potential blast areas have the option to have the condition of their property surveyed and documented by a Third-Party Specialist.
Summary of Blasting Procedures and Limitations

• Careful Geological Investigations
• Blast Planning and Review Procedures
• Blast Effect Controls are Applied
• Blasting Hours Limited : Daytime Hours no Weekends or Holidays
• Vibration and Noise Limitations
• Regular Inspections
• Results are Monitored
RENDERING OF FINISHED TANK

Tank Drawing
Here
QUESTIONS?