Public Assistance Debris Operations Job Aid
Estimating Debris Quantities

General: Initial quantity estimates are difficult to make, due to a number of factors: the type, magnitude, and geographical location of the disaster; geographical extent of the debris; the types and mix of debris, and the sometimes difficulties in gaining access to the affected area. It is important, however, to make as accurate an estimate as possible, and refine that estimate as work continues.

Become familiar with the general results of various types of disasters. Hurricanes, and tornados can produce large quantities of yard waste and construction materials scattered over a large area. Floods create large amounts of debris that may be buried in silt. Ice storms and snowstorms create large amounts of woody debris from broken limbs and branches. Many of the large broken limbs remain attached to the tree trunk and must be removed by professional tree trimmers.

Ensure that necessary equipment is available, including:
• Digital (preferred) or Polaroid camera. (Disposable Cameras)
• 100 foot tape or roll-off wheel
• Calculator, notepad, sketchpad
• Maps of area
• Aerial photographs (preferably before and after the disaster)
• Dedicated vehicle and mobile communications

Debris estimating can be expedited by dividing the community into sectors based on any of the following:
• Types of debris; woody, mixed or construction material
• Location of debris; residential, commercial or industrial
• Land use; rural or urban

Reminders: The following reminders may be of assistance when performing debris estimates:
• Look beyond the curb into side and backyards and at the condition of the homes. Most of the debris in these areas will eventually move to the curb.
• Wet storms will produce more personal property (household furnishings, clothing, rugs, etc.) debris if roofs are blown away.
• Look for hanging debris such as broken limbs after an ice storm.
• Flood-deposited sediment may be compacted in place. Volume may increase as debris is picked up and moved.
• Using aerial photographs in combination with ground measurements will help determine if there are any voids in the middle of large debris piles.
• Treat debris piles as a cube, not a cone, when performing estimates.
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Estimating Aids - Building: The following information will assist you in determining the amount of debris from destroyed buildings and mobile homes:

- One Story House Formula:

  \[ L' \times W' \times 8' = \text{cubic yards} \times 0.33 = \text{cubic yards of debris.} \]

  27' per cy

  (The 0.33 factor accounts for the "air space" in the house)

- The table below can be used to estimate debris quantities for a totally destroyed typical home. A vegetative debris multiplier is also included.

- Amount of personal property (as debris) from average flooded residence without a basement: 25-30 cy.

- Amount of personal property (as debris) from average flooded residence with a basement: 45-50 cy.

<table>
<thead>
<tr>
<th>Typical House (Square Feet)</th>
<th>VEGETATIVE COVER MULTIPLIER (YARD WASTE)</th>
<th>None</th>
<th>Light (1.1)</th>
<th>Medium (1.3)</th>
<th>Heavy (1.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 SF</td>
<td></td>
<td>98 cy</td>
<td>107 cy</td>
<td><strong>127 cy</strong></td>
<td>147 cy</td>
</tr>
<tr>
<td>1200 SF</td>
<td></td>
<td>118 cy</td>
<td>129 cy</td>
<td><strong>153 cy</strong></td>
<td>177 cy</td>
</tr>
<tr>
<td>1400 SF</td>
<td></td>
<td>137 cy</td>
<td>150 cy</td>
<td><strong>178 cy</strong></td>
<td>205 cy</td>
</tr>
<tr>
<td>1600 SF</td>
<td></td>
<td>155 cy</td>
<td>170 cy</td>
<td><strong>201 cy</strong></td>
<td>232 cy</td>
</tr>
<tr>
<td>1800 SF</td>
<td></td>
<td>175 cy</td>
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<td>195 cy</td>
<td>215 cy</td>
<td><strong>254 cy</strong></td>
<td>293 cy</td>
</tr>
<tr>
<td>2200 SF</td>
<td></td>
<td>215 cy</td>
<td>237 cy</td>
<td><strong>280 cy</strong></td>
<td>323 cy</td>
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<td>2400 SF</td>
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<td>235 cy</td>
<td>259 cy</td>
<td><strong>306 cy</strong></td>
<td>353 cy</td>
</tr>
<tr>
<td>2600 SF</td>
<td></td>
<td>255 cy</td>
<td>280 cy</td>
<td><strong>332 cy</strong></td>
<td>383 cy</td>
</tr>
</tbody>
</table>

- Single wide mobile home = 290 cy of debris
- Double wide mobile home = 415 cy of debris

Rule of Thumb:

- 15 trees 8 inches in diameter = 40 cy (average)
- Root system (8'-10' diameter) = Requires one flat bed trailer to move.
- To convert cubic yards of Construction and Demolition (C & D) debris to tons, divide by 2.
- To convert tons of C & D debris to cubic yards, multiply by 2.
- To convert cubic yards of woody debris to tons, divide by 4*.
- To convert tons of woody debris to cubic yards, multiply by 4*.
Debris Composition for Hurricanes: As a general statement, hurricanes are the biggest debris generators of all disasters. For planning purposes, it is sometimes useful to have an estimate of the composition of the debris expected from a hurricane. There is no exact composition data; the mix from Hurricane Andrew in Florida was generally 30% clean, woody debris and 70% construction and demolition debris. After Hurricane Fran in North Carolina, the mix was reversed – clean woody debris was 70%. Look closely at the areas impacted by the hurricane before projecting the mix. One type of debris that has a fairly consistent composition is mixed construction and demolition debris. A good average for that mix is:

- 42% burnable, but requires sorting (Check before burning, there may be prohibitions against burning construction debris).
- 5% soil.
- 15% metals.
- 38% Landfilled.

Reduction Rates:

- Burning: 95% reduction.
- Chipping and grinding: 75% reduction (average). This percentage may vary with the types of wood being chipped. It's best to carefully measure several piles of typical woody debris before they are chipped, then immediately thereafter, measure the amount of mulch generated.
- Tub-grinders have production rates ranging from 160 to 340 cubic yards per hour for brush and yard waste. Check production rates for specific equipment being used. Do not use Grinder Production Logs: they tend to over quantify production because they may apply engine hours, use an "ideal" rate of production; lack personnel to monitor equipment usage; have changes in conditions of debris, etc. Verify by monitoring operations.