Outline for Lime Seminar Including Burning and Slaking of Lime
First Draft, September 2008
Frederik Stevenson
LIME SEMINAR

Part 1   Introduction to lime

Basic Mortar:
- Binder
- Aggregate
- Water

Binders:

<table>
<thead>
<tr>
<th></th>
<th>Hydraulic</th>
<th>Non-Hydraulic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gypsum</td>
<td>Hydraulic lime</td>
<td>Mud</td>
</tr>
<tr>
<td>Hydraulic lime</td>
<td>Portland cement</td>
<td>Clay</td>
</tr>
<tr>
<td>Portland cement</td>
<td>Natural cement</td>
<td>Lime</td>
</tr>
</tbody>
</table>

Concentrate on lime – why use lime?

A tale of two limes
- what makes hydraulic hydraulic?
- what makes non hydraulic?

Introduction to Lime Cycle
1. Calcium carbonate heated gives off carbon dioxide to form calcium oxide
\[ \text{CaCO}_3 + \text{heat} \rightarrow \text{CaO} + \text{CO}_2. \]

2. Calcium oxide slaked (water added) give off heat and forms calcium hydroxide
(slaked in one of four ways explained) \( \text{Ca(OH)}_2 \)

3. Lime putty produced with excess of water – allowed to mature – forever – beaten with aggregate to form coarse stuff and used as mortar

4. Calcium hydroxide (mortar putty) combines with carbon dioxide in air to form \( \text{CaCO}_3 \) – calcite – as water evaporates same as limestone but different crystal structure

Part 2

Kiln technical requirements for building and firing kiln, and building and firing it. Must burn and sustain temperature for 12-16 hours.

Part 3

Slaking lime to make lime putty, and beating lime putty into mortar and setting a few bricks to demonstrate workability and stickiness of putty.

Part 4

Summary:
- Advantages of lime (recap)
- Disadvantages of lime
- Advantages of Portland cement
- Disadvantages of Portland cement

Requirements

Part 1
Blackboard and/or large easel and coloured markers/chalk

Part 2
Build kiln – minimum requirements:
- 400 refractory bricks ~ 8x4x2 or so
- two yards of high clay/sand mix
- heavy grill to burn on
- face cord dry hardwood cut to 12" lengths
⇒ 500 lbs limestone to burn – high calcium low magnesium
⇒ shop vac with blower capacity
⇒ concrete or gravel pad
⇒ chimney ~ ±3' stovepipe ±8” diameter fastened to steel plate
⇒ **some short pieces of rebar and grinder/chop saw
⇒ **it's possible that I can borrow some of this from Algonquin College as I will be doing a similar seminar with my class in November this year

Part 3
⇒ Source of hot water
⇒ Wheel barrow(s)
⇒ Hand trowels
⇒ Spray bottle
⇒ Mortar hoe
⇒ Rubber buckets and pick handles
⇒ Bricks to set

Part 4
Bag of Quicklime in case Part 3 doesn't work

Part 5
Timeline
⇒ Initial talk, with questions 1-2 hours
⇒ Assembly and charging kiln assuming all materials on hand 3-4 hours
⇒ Burn lime 12-16 hours
⇒ Cool down 4-6 hours
⇒ Slake and make putty, beat in sand to make mortar 2 hours

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1 Lime cycle reproduced from TAN#1, Historic Scotland