

THE GREAT STUPA OF DHARMAKAYA

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| A STUPA?



A spiritually empowered monument



Which liberates on seeing



To honor
Chögyam Trungpa Rinpoche,
The founder of the
Shambhala Mountain Center



BUT...



The Location is at
Red Feather Lakes,
Rocky Mountains, Colorado.



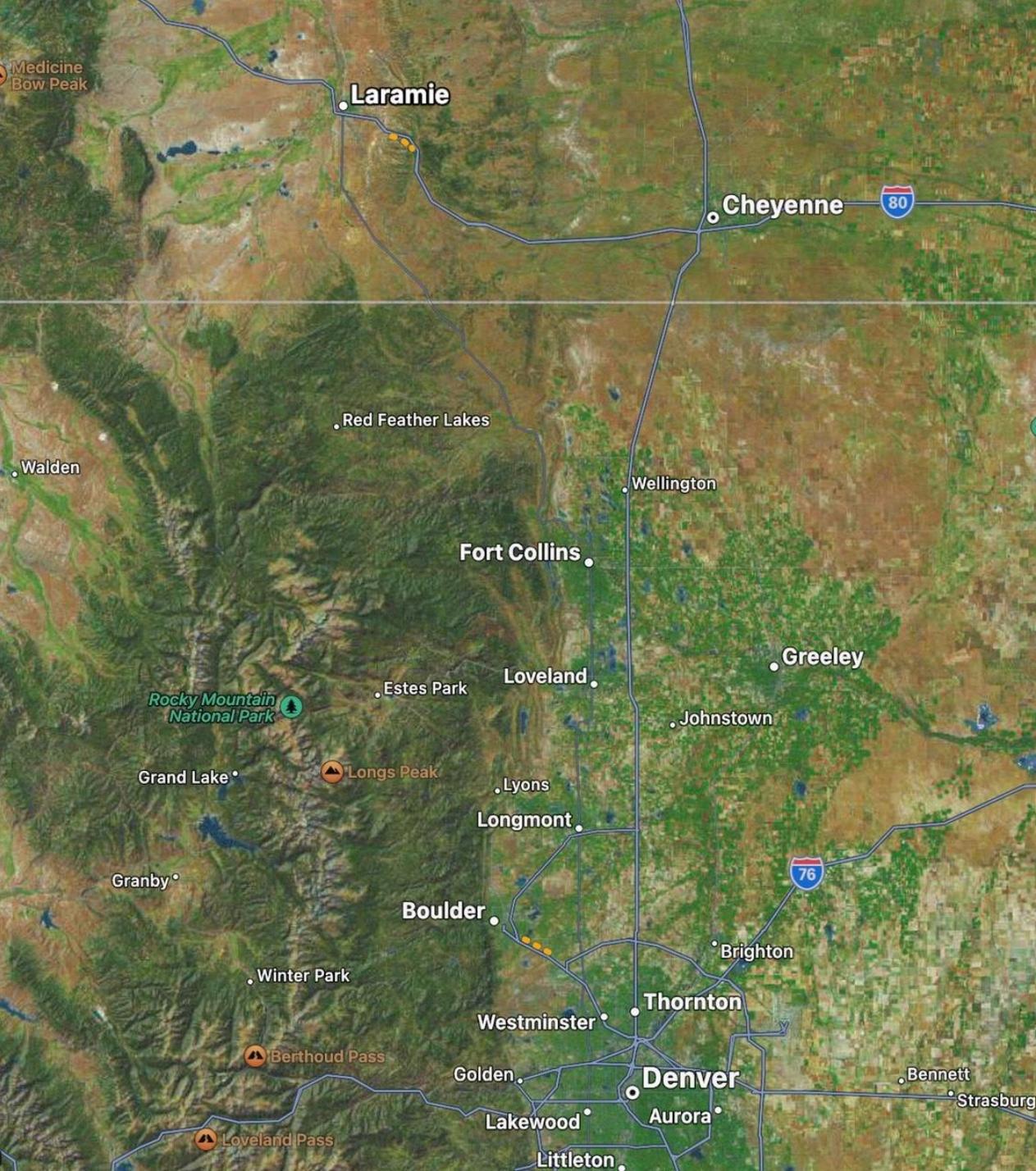
It's at **8,500** feet elevation
(~2,600m),
and the local ready-mixer is
in Fort Collins.



And we'd like the concrete
to last for more than
1,000 years, please.

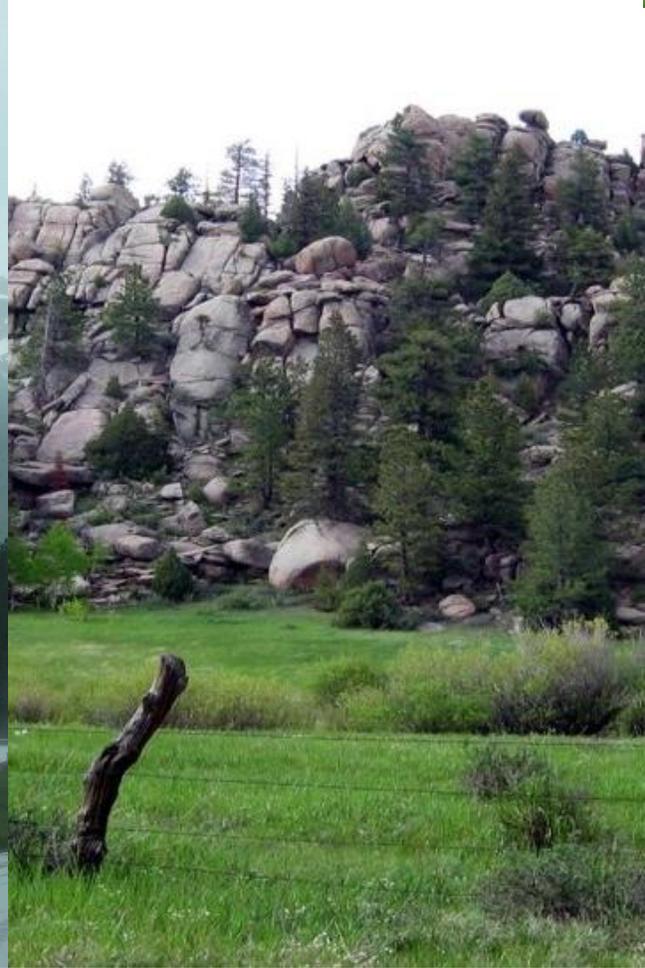


**Plus, it's being built by
volunteers, so it may take
some time... like... years...**





It can be a bit rough in winter



Not a lot of roadway



Access is a bit difficult



It's fine during summer, once you're there

Okay, we're going to have to think about that mix design then...

Strength? 6,000 psi @ 28 days

Anything else? Entrained Air @ 5%

And don't forget 1,000-year lifetime...

A FEW MORE THOUGHTS...

It's going to take about an hour for the ready mix trucks to get to 'the bottom of the hill' – then it's going to be 'manhandled' to the site...

There's going to be some big blocks to pour and some delicate facias to cast, so we'll want a creamy mix with good workability, at the site, for a couple of hours or so...

With that time frame, that's going to be tough for the air entrainment if we don't want to lose any air...

Good amount of Class 'C' fly ash in there – long term strength and durability.

Addition of silica fume – seal it up from the start – extra strength, water, chloride and sulfate resistance – enhanced durability.

That triple blend will give a fine paste, so a good finish for facias and a dense surface to resist damage.

WHAT ABOUT THAT AIR?

'just on the market' was a product called *Micro-air*.

1st synthetic air entrainer.

Well, here's a "Baptism of Fire" for it...

Target: 100% freeze thaw resistance = 300 cycles.

Achieved over 500 cycles – and at that elevation, the cycles would not be as frequent as usually expected.

CONCRETE MIX DESIGN AND STRENGTHS

Mix Design Materials :	lbs / yd ³	kg / m ³
Cement, Type I / II	730	433
Fly Ash, Class C (11 % replacement)	94	56
Silica Fume (9 % addition)	76	45
Aggregates	to yield;	5 % air-entrained
High Range Water Reducer	1.3 - 1.5 gal / yd ³	4 - 5 ltr / m ³
Water / Cementitious Ratio	0.35	0.35
7 day compressive strength	6,900 psi	48 MPa
28 day “	8,700 psi	60 MPa

DID ANYONE THINK OF THE CARBON FOOTPRINT?

Not at the time, but:

Using general figures for OPC, Fly Ash and Silica Fume of 950kg; 90kg and 15kg per tonne respectively, the variations that could have been used come out at:

Pure OPC	507kg
OPC and Silica Fume	462kg
OPC and Fly Ash	456kg
<u>OPC and Fly Ash plus Silica Fume</u>	<u>417kg.</u>

The triple blend had the lowest carbon footprint anyway...

BIG AND SOLID FOR THE MAIN PART



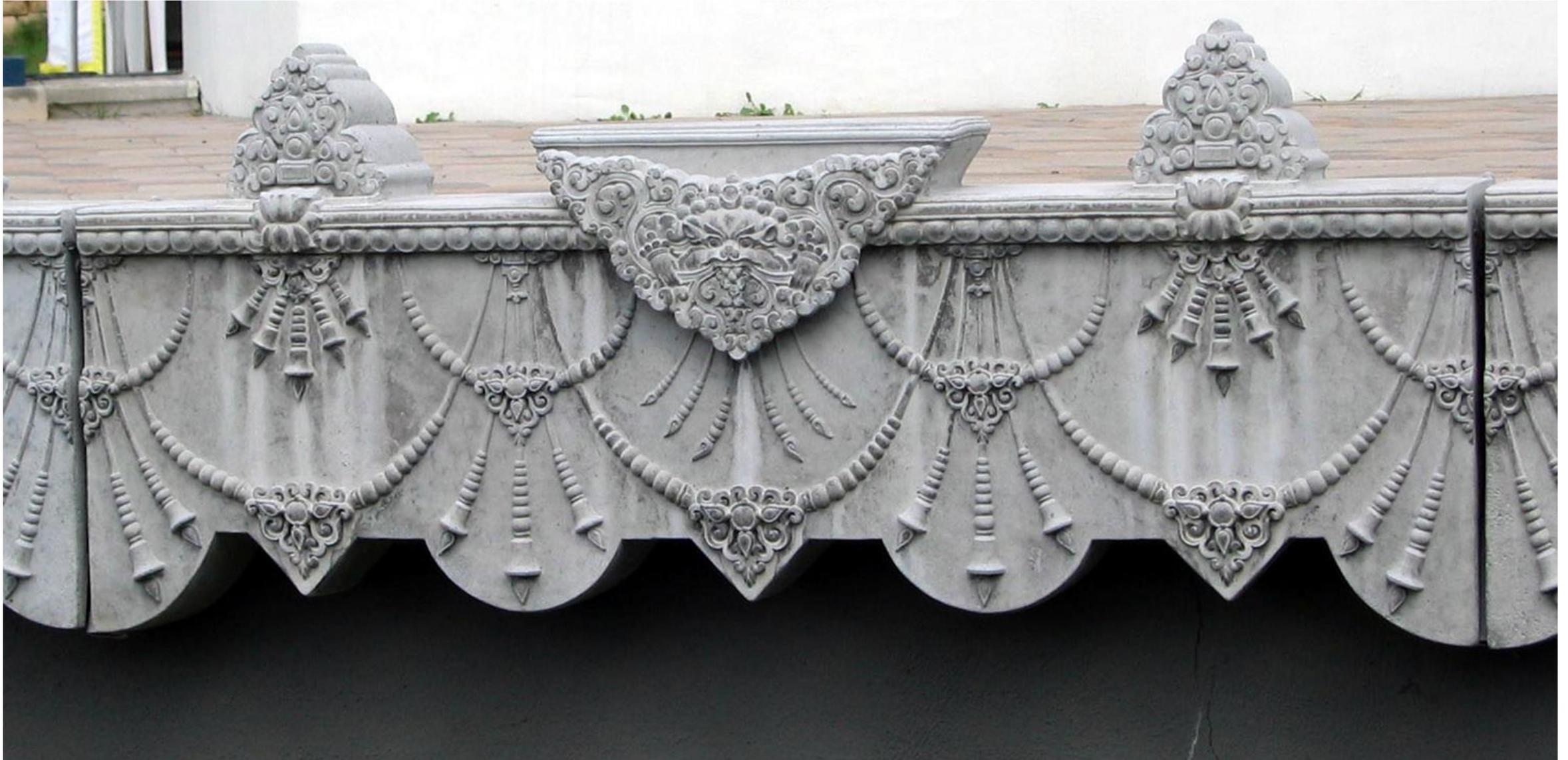
SHARP LINES AND SMOOTH SURFACES



NOT BAD FOR CAST IN-SITU



DELICATE FACIA FINISH



CLOSE UP.



EXTERIOR FINISHING





The Great Stupa of Dharmakaya

It took over 15 years to build – but the result is truly impressive!

And yes, it probably does stand a good chance of lasting 1,000 years.

Thank you.

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