

Optimisation formulations - brainstorming

Graham Burgess

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We start off with the a general optimisation formulation detailed below (as discussed in meeting of 15th Feb 2024). This formulation minimises a deterministic objective function subject to baseline building constraints and a total budget constraint.

Let $T \in \mathbb{Z}^+$ be a fixed horizon over which to model queue behaviour and to make building decisions.

Let vectors $\mathbf{h} = \{h_t \ \forall t \in 1, \dots, T\}$ and $\mathbf{s} = \{s_t \ \forall t \in 1, \dots, T\}$ denote annual house and shelter building rates, respectively. For simplicity we say that housing/shelter building rates are constant within each year.

Let $c_h = 1$ be the cost of increasing h_t by one, for any t .

Let c_s be the cost of increasing s_t by one, for any t .

Let C be a total budget for building housing and shelter

Let B be a baseline minimum annual house/shetler building rate

Let $y(\mathbf{h}, \mathbf{s})$ be a deterministic objective function, evaluated using the fluid flow model.

$$\begin{aligned} \min_{\mathbf{h}, \mathbf{s}} \quad & y(\mathbf{h}, \mathbf{s}) \\ \text{s.t.} \quad & \sum_{t=1}^T c_h h_t + c_s s_t \leq C \\ & h_t, s_t \geq B \ \forall t \in \{1, \dots, T\} \end{aligned}$$