Research Centre for Integrated Transport Innovation (rCITI)

Let us take you there

A simple crowdsourced delay based traffic control

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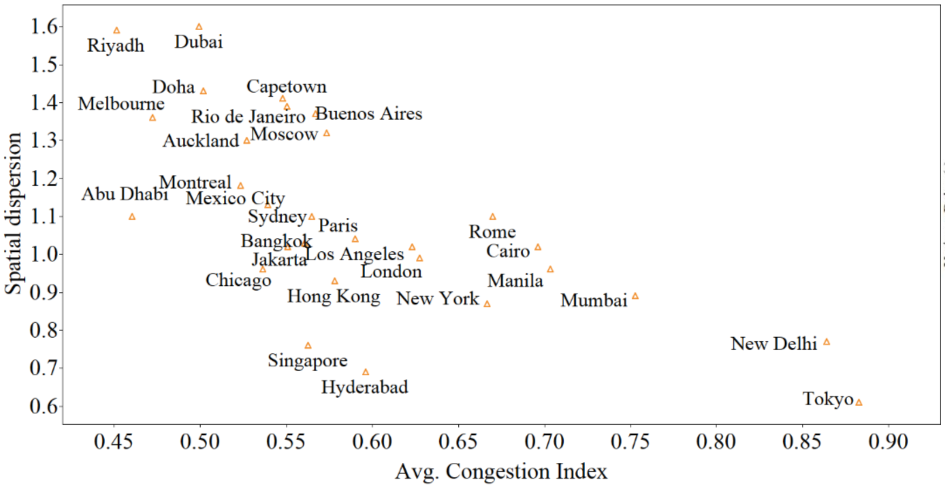
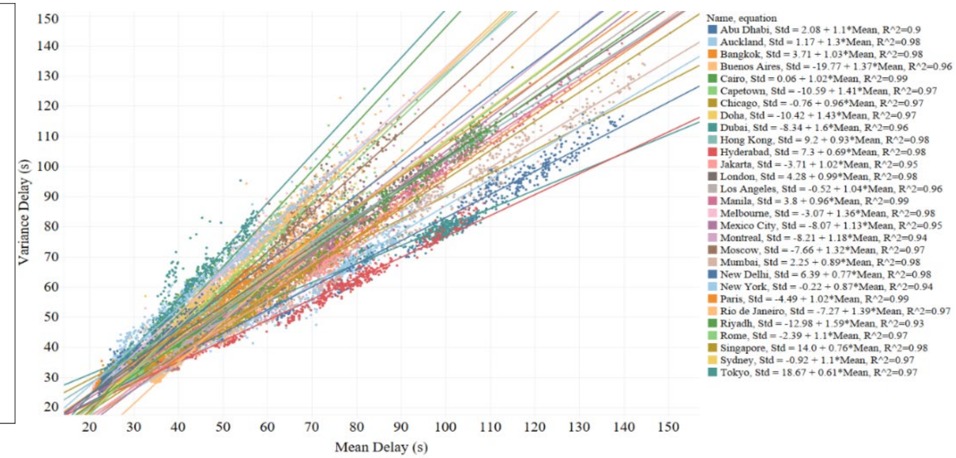
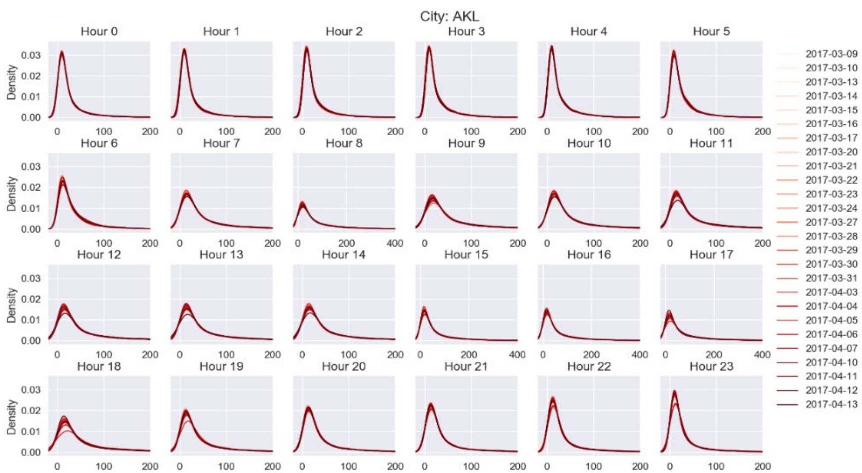
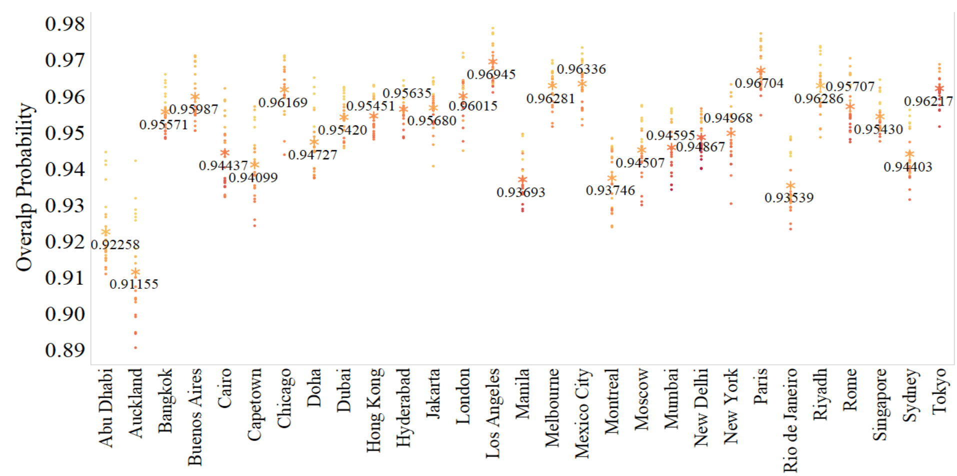
Multicity Traffic conditions





Spatial Heterogeneity



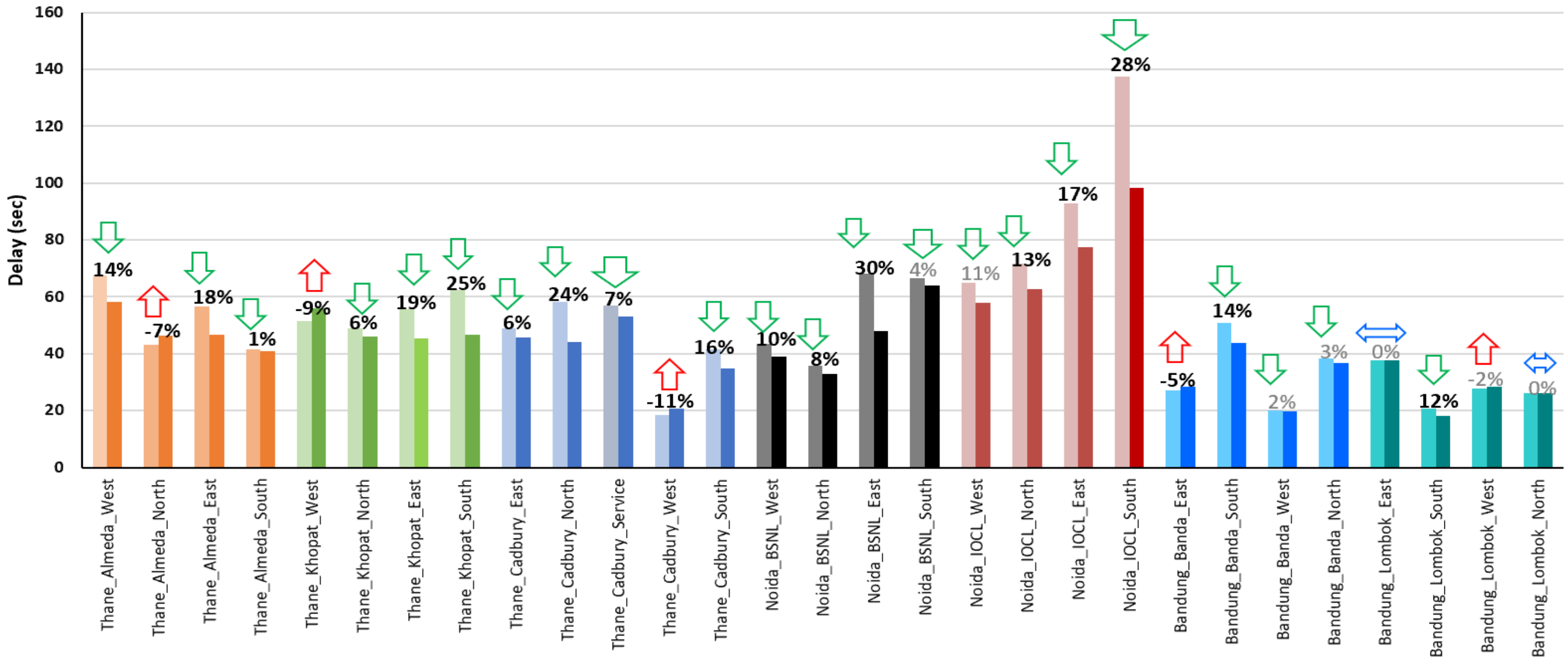


Network Stability

Individual Intersection

Theorem: Given a fixed cycle time, a green time that ensures clearance of queues is $g_i^* = \frac{(T_i/\mu_i)}{\sum_j (T_j/\mu_j)}(C - L)$. This policy is stable only if $\lambda_i \leq \frac{(C-L)}{\sum_j (T_j/\mu_j)}$

Max Pressure Term: $P_i = T_i/\mu_i$



Literature on Max Pressure

study	weight	pressure	proved stable
Wongpiromsarn et al. (17)	$w_{ij} = x_i(t) - x_j(t)$	$w_{ij}(t)\xi_i(p, \mathcal{L}_i, \mathcal{L}_i, z_i(t))$	Y
Varaiya (15)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	$Q_{ij} w_{ij} S_{ij}$	Y
Xiao et al. (19)	/	$P_{ij}(t) = \frac{\alpha_{ij}\left[\sum_{(i',j') \in \mathcal{L}_{ij}^{(\text{in})}} x_{i'j'}(t)\right]}{Q_{ij}} x_{ij}(t)$	Y
Gregoire et al. (2)	$w_{ij}(t) = \min(x_{ij}(t)/Q_{ij}, 1)\max(P_i(t) - P_j(t), 0)$	$P_i(t) = \sum_{j \in \Gamma_i^+} P_{ij}(x_{ij}) = \sum_{j \in \Gamma_i^+} \theta_{ij} x_{ij}$	N
Le et al. (6)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	/	Y
Gregoire et al. (3)	$w_{ij} = \max(P_i(t) - P_j(t), 0)$	$P_i(x_i) = \min\left(1, \frac{\frac{x_i}{Q_\infty} + \left(2 - \frac{x_i}{Q_\infty}\right)\left(\frac{x_i}{Q_i}\right)^m}{1 + \left(\frac{x_i}{Q_i}\right)^{m-1}}\right)$	Y
Pumir et al. (11)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	$Q_{ij} w_{ij} S_{ij}$	Y
Zaidi et al. (20)	$w_{ij}(t) = \max\{x_i(t) - x_j(t), 0\}$	$w_{ij}(t) S_{ij}(t)$	N
Le et al. (7)	$w_\psi(t) = \sum_{i \in \Gamma_j^-} \psi_i(x_i(t) - \sum_{j \in \Gamma_i^+} \bar{\theta}_{ij}(t) x_j(t))$	/	Y
Hsieh et al. (4)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	$Q_{ij} w_{ij} S_{ij}$	Y
Wu et al. (18)	$w_{ij}(t) \triangleq T_{ij}(t)$	$\gamma_{ij} w_{ij}(t) S_{ij}$	Y
Li and Jabari (8)	$w_{ij}(t) = f(l_i, l_j, c_{ij}, \pi_{ij}, \delta_{ij}, \theta_j)$	$w_{ij}(t)\mathbb{E}^{\rho(t)} q_{ij}(p)$	Y
Rey and Levin (12)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	$w_i(t) y_i(t)$	Y
Lioris et al. (9)	$w_{ij} = x_{ij} - \sum_{k \in \Gamma_j^+} x_{jk} p_{jk}$	$Q_{ij} w_{ij} S_{ij}$	N
Kouvelas et al. (5)	/	$P_i(t) = \left[\frac{x_i(t)}{x_{i,\max}} - \sum_{j \in O_n} \frac{\beta_{ij} x_j(t)}{x_{j,\max}} S_n(t)\right] Q_i, i \in I_n$	N

Network Max Pressure

$$x_{ij}(t+1) = x_{ij}(t) - y_{ij}(t) + \sum_{h \in \Gamma_i^-} y_{hi}(t) p_{ij}(t) \qquad \forall i \in \mathcal{L}_{\text{int}}, h \in \Gamma_i^-, j \in \Gamma_i^+$$

$$x_{ij}(t+1) = x_{ij}(t) - y_{ij}(t) + d_i(t) p_{ij}(t) \qquad \forall i \in \mathcal{L}_{\text{entry}}, j \in \Gamma_i^+$$

$$y_{ij}(t) = \min\left\{Q_{ij} s_{ij}(t), x_{ij}(t)\right\}$$

Flow Propagation

$$w_{ij}(t) = \tau_{ij}(t) - \sum_{k \in \Gamma_j^+} \tau_{jk}(t) p_{jk}(t)$$

Weights

$$S^\star(t) = \arg\max_{S_n \in \mathcal{S}_n} \left\{ \sum_{(i,j)} Q_{ij} w_{ij}(t) s_{ij}(t) \right\}$$

pressure

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Travel Time Function

$\textit{Total Travel Time}$: $$T_{ij}(t) = \sum_{\tau=1}^{\infty} \tau x_{ij}^{\tau}(t)$$ **Monotonic**

$\textit{Average Travel Time}$: $$\tau_{ij}(t) = \frac{\sum_{\tau=1}^{\infty} \tau x_{ij}^{\tau}(t)}{x_{ij}(t)}$$ **Non-Monotonic**

$$x_{ij}^{3}(t) = 2$$
$$\Rightarrow w_{ij}(t) = \frac{3\text{x}2}{2} = 3$$

$$\sum_{j} y_{ij}(t+1) = 1$$
$$\sum_{j} y_{ji}(t+1) = 2$$

$$x_{ij}^{3}(t+1) = 2$$
$$\Rightarrow w_{ij}(t+1) = \frac{1\text{x}2 + 1\text{x}4}{3} = 2$$

$\textit{Travel Time}$: $$w_{ij}(t) = \frac{x_{ij}(t)}{Q_{ij}(t)}$$ **Monotonic**

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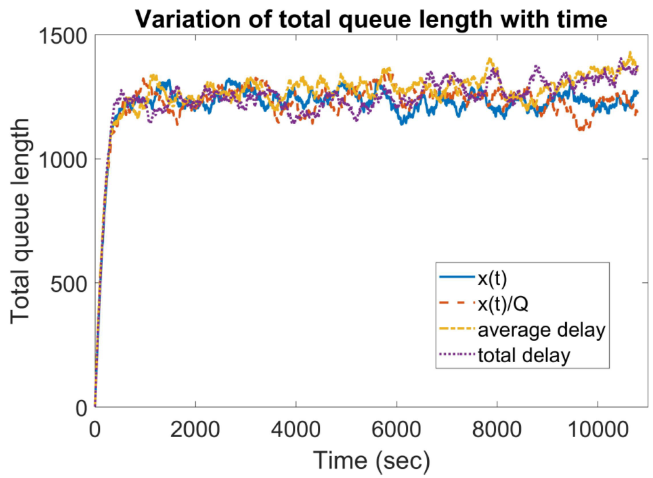
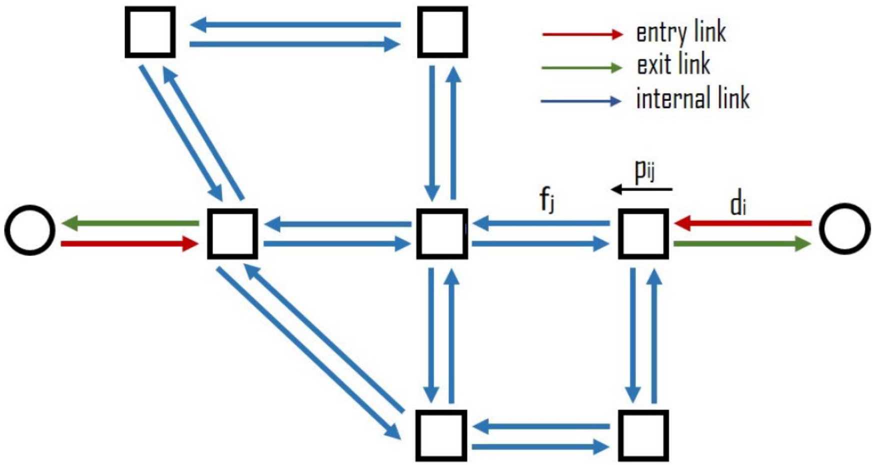
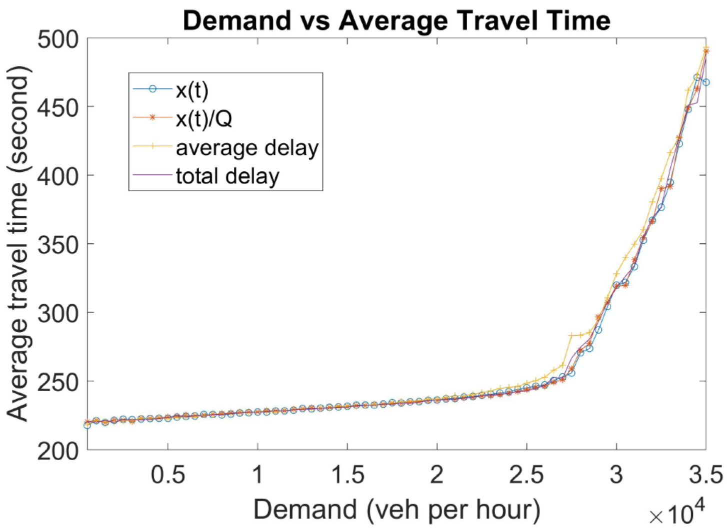
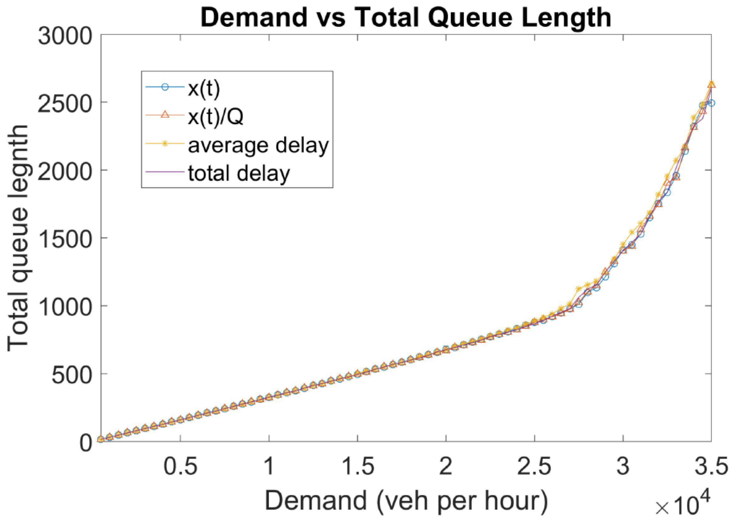
Simulation Results









THANK YOU!