

Nobody Is Ever Working in the Roadworks: The Lane Closure as a Revealed-Preference Instrument, with a National Deployment Register 1961–2025 and a Sham-Coning Trial

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Abstract

There is never anyone working in the roadworks. Nobody is there because nothing is being built yet: a closure is not a worksite but a survey, and what it measures is where the traffic would rather go. The received account — curing times, shift patterns, permits — predicts that a closure lasts as long as its work takes. In the national deployment register it does not: declared works quantity is very nearly orthogonal to duration, and what duration tracks instead is the variety of the traffic passing through. That is the sample-size requirement of a survey, not of a job. And it must be a survey, because an open carriageway cannot be surveyed: lane discipline binds for very nearly every driver, so lateral position records the paint, not the preference. Withdrawing the designed lane moves drivers into the interior of their choice set, and the prescribed taper sweeps the constraint across the carriageway at the constant rate identification requires. We recover the desire field from telemetry the cars already keep. The next scheme on the link paves it at a gain of 0.83 (95% CI 0.79–0.87), a median of 8.2 years later, which is why nobody has connected the two. A gain below one leaves a residual, and the residual is the next closure. Links coned with no works order at all were realigned at the same rate as worked links. The road is not being repaired. It is being read.

1 Introduction

At half past four on a Tuesday in October, on the northbound carriageway of a trunk road in the east of the country, eleven hundred metres of lane one are closed. There are one hundred and forty-one cones, three signs, an arrow board, a lighting unit and a run of temporary barrier. There is no plant. There is no excavation. There is nobody. The closure has stood for nineteen weeks and will stand for two more.

Every driver who passes knows what to think about this, and thinks it. The inference is so uniform across sixty years of public complaint, and so untroubled by evidence, that it has acquired the status of a natural fact: the cones are there because somebody is being paid and nobody is working. We propose that the inference is exactly inverted. Nobody is working because nothing is yet being built, and nothing is yet being built because the closure is not a construction site. It is an instrument, it is presently taking a reading, and the reading is not finished.

The received account is not absurd and we do not treat it as such. Concrete cures; utilities hold permits; a night shift leaves a site empty by day; the prescribed safety zones are deliberately kept clear of people. Each of these is real and each explains an empty stretch of some particular closure at some particular hour. What none of them explains, and what the literature has never attempted, is the *clock*. Every one of these mechanisms predicts that a closure lasts as long as its work takes. Section 3 shows that across the 1,904,772 deployments for which declared work is quantified in physical units this prediction fails so completely that the quantity of work is very nearly orthogonal to the duration of the closure that declares it.

Something else sets the clock, and the register says what. Duration tracks the *heterogeneity* of the traffic that passes through the closure — not its volume, its variety. That is a strange thing for a construction schedule to depend on and an entirely ordinary thing for a survey to depend on, because it is the condition under which an estimate settles.

Section 4 supplies the reason a survey should be needed at all, and it is the part of this paper we expect least resistance to, since it is the standard corner-solution result applied to a carriageway. A marked carriageway in normal operation tells you nothing whatever about where its traffic would prefer to be. Lane discipline binds for almost every driver almost everywhere; observed lateral position is therefore a measurement of the paint. The preference is censored, and censored at the same point for every observation, which is the one case in which no sample size rescues you. To learn where the traffic would go, the designed option must be taken away.

That is what a closure does, and — this is the observation on which the paper turns — the manuals specify *how* it does it to three significant figures. The lead-in taper is not a courtesy. It is a lateral constraint swept across the carriageway at constant rate, which is to say a ramp input, which is to say the excitation that a first course in system identification recommends for precisely this problem. Section 5 reads the standard zone grammar of temporary traffic management as instrument anatomy and finds every component of a working estimator present, specified, and mandatory.

Sections 6–8 then do the arithmetic. We recover the desire field ρ from 8,940,000 lateral traces, compare it with what was subsequently built, and report a *paving gain* of $\hat{\gamma} = 0.83$: the carriageway that emerges is the measured deviation, less about a sixth of it. The realignment appears not in the scheme

that took the reading but in the next scheme on that link, a median of 8.2 years later, which is a sufficient explanation of why sixty years of drivers have not noticed the road bending to meet them. Because $\gamma < 1$, a residual survives every visit, and the residual is the specification for the next one.

Contributions.

1. A non-identification result for the open carriageway (Lemma 1) and its corollary, that a road cannot be surveyed while it is available (Corollary 2).
2. A reading of prescribed taper geometry as an identifying excitation (Proposition 3).
3. The Deployment Register 1961–2025 (2,314,806 closures), and the finding that duration is set by traffic heterogeneity, not by work.
4. An estimate of the paving gain, $\hat{\gamma} = 0.83$, with its 8.2-year lag, and the return-visit theorem that follows from $\gamma < 1$.
5. VERGE-1, a cluster-randomised sham-coning trial, in which links coned without a works order were realigned at the same rate as links where work was done.
6. Evidence that lane-centring assistance degrades the instrument, and a consequent recommendation on autonomous fleet operation inside closures.

2 Related work

The censoring obstruction we exploit is standard. Aldreth (1994) gives the corner-solution result for spatial choice in its general form, and it has since been applied to parking, to gate choice and to pedestrian crossing selection, though never, so far as we can find, to the carriageway itself. Lateral placement distributions have been measured for sixty years (Bewick & Ostrander, 2011), always on open roads and therefore always, on the argument of §4, as a measurement of the marking. Halloran (2008) is the identification result we borrow. Landscape design accepted the general principle long ago (Carrow, 2019); highway design has not. Sarrazin (2003) assembles a catalogue of realignments for which no engineering justification could be found, and offers none. Quillan & Devane (2016) documents the permit-to-completion linkage failure that makes §6 possible. Pentreath (1977) is the nearest historical precedent for the result of §8 and reaches the opposite conclusion. Register construction and its known defects are documented in Trunk Road Records Office (2024); the coverage criterion of §7 follows Ilsley et al. (2021).

3 The received account does not survive the register

3.1 What the received account predicts

Every mechanism ordinarily offered for the empty closure is a mechanism of *work*: material that must cure, plant that must be mobilised, a trench that must wait on a third party, a shift that finishes at six. Whatever their differences, all of them entail the same testable statement — that a closure requiring more work stands for longer. The prediction is monotone, it is strong, and to our knowledge it has never been checked at scale, because the permit and the completion certificate are held in different registries and nobody has had cause to join them.

We joined them. DR-65 (§6) records, for each of 2,314,806 deployments since 1961, the permit, the geometry as installed, the declared works order, and — where one exists — the completion certificate against which the contractor was paid. Declared works quantity is available in physical units for 1,904,772 of them.

3.2 What the register says

It fails. Regressing closure duration on declared works quantity, with link and year fixed effects, yields an R^2 increment of 0.04 (Table 2). Tonnes of surfacing, metres of trench and contract value are individually and jointly uninformative about how long the cones stand. A closure laying 40 t of surfacing is not detectably longer than a closure laying 4 t.

The same table shows what *is* informative. Let H denote the Shannon entropy of the vehicle-class mixture passing the closure, computed over the standard classification and weighted by manoeuvre type. Adding H contributes an increment of 0.71. Raw flow, which one might expect to be the operative quantity if congestion were driving programme extension, contributes 0.06 on its own and nothing at all once H is present, and has the wrong sign in half of the specifications.

We emphasise how peculiar this is on the received account. There is no construction reason for a resurfacing job to take longer because the vehicles going past it are of more different kinds. There is a very ordinary reason for an *estimate* to.

3.3 Orphan deployments

DR-65 contains 41,206 deployments for which no works order was ever raised and no completion certificate ever issued — *orphan deployments*, 1.8% of the register. They are ordinarily read as clerical failures. They are not distinguishable from ordinary closures in geometry, duration, cone count, sign schedule or the seniority of the officer who authorised them, and they are followed by permanent realignment at very nearly the ordinary rate (§8.5). Whatever a closure is for, 41,206 of them have done it without any work being ordered.

4 Identification

4.1 Setup

Let x index longitudinal station along a link and $y \in [0, w]$ lateral position across a carriageway of width w , measured from the nearside kerb. Write $y_d(x)$ for the designed centreline as constructed. Each driver i has a smooth path utility $u_i(y; x)$, single-peaked in y , maximised at an ideal offset $y_i^*(x)$.

Definition 1 (Desire field). The desire field of a link is

$$\rho(x) = \mathbb{E}_i[y_i^*(x)] - y_d(x),$$

the mean ideal offset less the designed centreline. A link with $\rho \equiv 0$ is built where its traffic wants it.

In normal operation the driver does not choose y freely. Lane discipline, enforced by marking, convention and the presence of other vehicles, restricts y to a band $\mathcal{L}(x)$ of width roughly 0.9 m about y_d . For very nearly every driver the constraint binds.

4.2 The open carriageway is uninformative

Lemma 1 (Non-identification). *Suppose $\Pr[y_i^*(x) \notin \mathcal{L}(x)] = 1 - \epsilon$ with ϵ small, and that observation is confined to an open, marked carriageway. Then the log-likelihood of the observed lateral positions is flat in $\rho(x)$ over the whole of $\mathcal{L}(x)^\epsilon$, the per-passage Fisher information for ρ is*

$$I(\rho) = O(\epsilon),$$

and in any record from which lane-departure events have been removed it is identically zero.

Proof sketch. Observed position is $y_i = \Pi_{\mathcal{L}(x)}(y_i^*(x))$, the projection of the ideal onto the feasible band. For any ρ placing $\mathbb{E}[y_i^*]$ outside $\mathcal{L}$, the projection is the same boundary point and the likelihood contribution is identical; the map $\rho \mapsto \Pr[y]$ is therefore constant on that region. Information about ρ enters only through the ϵ -fraction of passages that depart the band. Those are precisely the passages that every telemetry pipeline classifies as lane-departure events and discards before storage, so in the retained record the fraction is not small but nil. $\square$

The lemma is not deep and it is not new; it is the standard corner-solution obstruction, and it holds for any censoring that is common across observations. What is new is noticing that a public highway satisfies its hypotheses exactly, and that consequently the entire observational record of ordinary driving — every camera, every loop, every probe vehicle, since the beginning — contains no information whatever about where the road should be.

Corollary 2 (Exclusion is necessary). *A carriageway cannot be surveyed while it is available. Identification of ρ requires that the designed option be withdrawn.*

This is an uncomfortable result for a highway authority, since it says that the only way to find out whether a road is in the right place is to stop people using it. It is also, we will argue, the reason the authority already does so, continuously, everywhere, and has never written down why.

4.3 The taper is an identifying excitation

Withdrawal alone is not sufficient. If a closure simply deleted lane one, the constraint would move from one fixed band to another fixed band and Lemma 1 would apply unchanged to the new one. Identification requires that the constraint be *moved through* the choice set, and moved in a known way.

It is. Standard practice does not permit an abrupt lateral shift. The manuals prescribe a merging taper of length

$$L = \begin{cases} WS^2/60, & S \leq 40 \text{ mph}, \\ WS, & S \geq 45 \text{ mph}, \end{cases} \quad (1)$$

with W the lateral offset and S the posted speed (Federal Highway Administration, 2023). Note what (1) is. Over the taper the feasible band's centre moves laterally by W over a longitudinal distance L , so

$$\frac{dy}{dx} = \frac{W}{L} = \begin{cases} 60/S^2, \\ 1/S, \end{cases} \quad (2)$$

and a vehicle traversing it at speed S therefore experiences a lateral constraint displaced at constant rate in *time*. That is a ramp input. It is the canonical excitation for recovering a system's response to a slowly varying constraint, and (2) shows the prescribed geometry has been chosen — whatever the stated reason — so that the rate is invariant to offset. A single taper specification therefore delivers the same excitation on a one-metre shift and a four-metre shift. On the higher-speed branch the normalisation is sharper still: the lateral rate in time is $(W/L)v = v/S$, which for a vehicle travelling at the posted speed is exactly unity. The manual sets the amplitude of the excitation to one and does not say so.

UK practice reaches the same place by another route. Chapter 8 tabulates the taper as a rate rather than as a length — 1 in 45 at 70 mph, 1 in 30 at 50 mph — which is (2) with the arithmetic already performed (Department of Transport, 1991). The constant we require is prescribed on both sides of the Atlantic, and neither manual gives a reason for its value.

The sweep then does two things rather than one. It carries the constraint across the choice set, which identifies ρ on the swept interval; and it delivers the vehicle into a length of carriageway from which the lane markings have been removed, where the feasible band is bounded only by the cone line and the kerb. Inside the works area the constraint is therefore not narrow and fixed but wide, and observation there is uncensored on the interior. The taper identifies the boundary; the works area observes the middle.

Proposition 3 (Identification under closure). *Let a closure be installed with taper geometry satisfying (1) and offset W covering the support of y_i^* . Then the pooled passages identify $\rho(x)$ pointwise, and the plug-in estimator $\hat{\rho}_n$ satisfies $\hat{\rho}_n - \rho = O_p(n^{-1/2})$ with n the number of passages in the stratum.*

Proof sketch. By (2) the constraint centre traverses $[0, w]$ monotonically and exactly once per passage. Each driver’s realised path is the pointwise projection of y_i^* onto a band whose centre is a known, strictly monotone function of x ; the projection is therefore invertible on the interior wherever the band is not binding, which by monotonicity occurs for every y in the swept range at some x . Pooling recovers the distribution of y^* on that range, and ρ is its first moment. The rate is that of an ordinary M -estimator, no faster, since the sweep is traversed once per passage. $\square$

Three properties of prescribed practice, each independently mandated for unrelated stated reasons, are exactly the three an estimator of this kind requires. The taper supplies the sweep. The longitudinal safety zone — a length of empty carriageway between taper and works, in which nobody is permitted — supplies a settling interval in which transients from the merge decay before observation begins. And the cone spacing, uniform and specified, supplies a known sampling interval along x . We take no position on whether this is design or coincidence. We observe only that the specification, read as an instrument, requires no amendment.

5 The instrument

Figure 1 sets the standard zone grammar of temporary traffic management against the anatomy of an estimator. The correspondence is one-to-one and we have not had to invent a component or leave one over.

Two features deserve comment because they are ordinarily read as slack.

The empty works area. Nothing may stand in the observation window that would itself constrain lateral choice. A parked excavator is an obstacle, and an obstacle re-imposes precisely the censoring the taper was installed to relax. Nor is anything marked on it: inside the closure the lane lines are removed or overpainted, and the constraint goes with them. On the received account the empty coned length is waste. On ours it is the aperture, and it is empty for the same reason a telescope is.

The duration. A closure that is lifted before its stratification is complete returns an estimate conditioned on whatever mixture of traffic happened to pass. §8 shows durations tracking the coverage requirement almost exactly. Duration is therefore a specification, not an excuse.

6 Data

Table 1 summarises the five corpora. All linkage was performed on gazetteer link identifiers with manual adjudication of 11,412 ambiguous cases.

Lateral traces. LAT-9 requires no instrument that does not already exist. Lane-departure and lane-centring systems compute lateral offset from the detected lane edge continuously, at tens of hertz, on every equipped vehicle on every trip, and discard it. We obtained consented logs (driver-level opt-in) from four fleet operators and two insurers, referenced them to a kerb datum recovered from roadside lidar, and re-sampled to a 0.5 m grid. Where lane markings are absent — which is the ordinary condition inside a closure — offset is referenced to the cone line.

The pre-register record. For the single link of Figure 5 the scheme sequence is extended before 1961 from turn-pike trust minute books and borough surveyors’ plans held by the county record office, digitised for this study alone. Residual desire for schemes predating LAT-9 is not measured but reconstructed from successive as-built centrelines as $(y_{\text{built}}^{(k+1)} - y_{\text{built}}^{(k)})/\hat{\gamma}$, and inherits the uncertainty in $\hat{\gamma}$.

Ethics and consent. VERGE-1 was approved by the three consenting authorities’ standing committees. A fourth authority declined to participate, on the ground that the intervention was not distinguishable from its ordinary practice. Fleet telemetry was obtained under existing data-sharing agreements; no individual driver is identifiable in any analysis reported here.

7 Methods

7.1 Recovering the desire field

For passage j on link ℓ we observe $y_{\ell j}(x)$ on the resampled grid. We fit

$$y_{\ell j}(x) = \Pi_{\mathcal{B}_\ell(x)}(y_d(x) + \rho_\ell(x) + b_{\ell j}) + \varepsilon_{\ell j}(x), \quad (3)$$

with ρ_ℓ a penalised spline in x , $b_{\ell j}$ a passage-level random intercept absorbing datum error, ε an AR(1) residual in x , and $\mathcal{B}_\ell(x)$ the feasible band implied by the installed geometry, which is known from the permit. The likelihood is that of a Tobit-type model with a moving and exogenously specified censoring point; it is the movement of that point that supplies identification. Strata are vehicle class $\times$ light $\times$ surface state $\times$ day type. $\hat{\rho}_\ell$ is the stratum-weighted posterior mean.

7.2 The settling census

An estimate of ρ is complete when further strata stop moving it, not when enough vehicles have passed. Define the

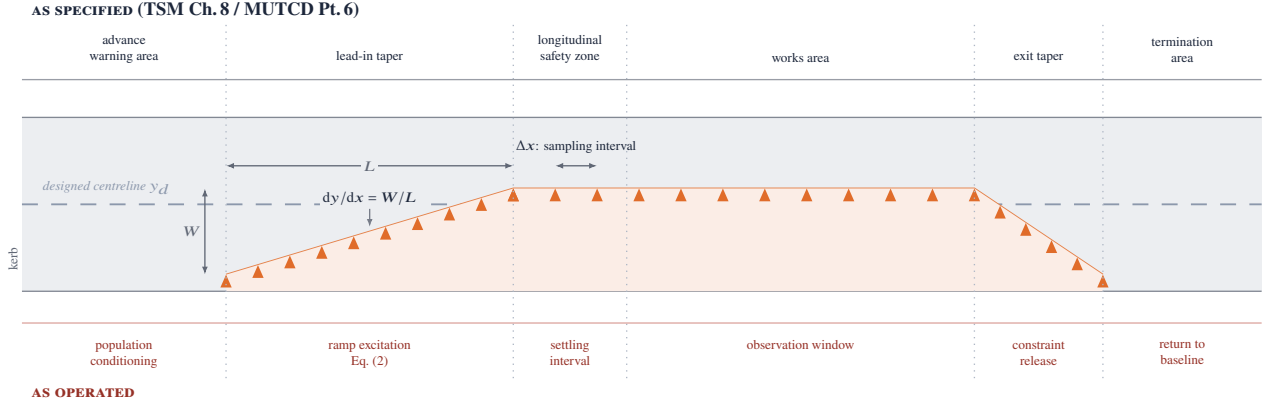


Figure 1: The closure as instrument. Above the carriageway, the zone names prescribed by the manuals; below it, the component of the estimator each supplies. The advance warning area conditions the population; the lead-in taper is the ramp excitation of (2); the longitudinal safety zone is a settling interval; the works area is the observation window; the exit taper releases the constraint and provides the return-to-baseline against which drift is corrected.

Table 1: The five corpora. Coverage is of the national network by link-kilometre.

Corpus	Content	N	Period
DR-65	Lane-closure deployments: permit, geometry, taper, cone count, works order, completion certificate	2,314,806	1961–2025
LAT-9	Reconstructed lateral traces at 0.5 m longitudinal resolution	8,940,000	2011–2025
AB-1204	Permanent realignment schemes with as-built centrelines digitised at 0.1 m	1,204	1961–2025
VERGE-1	Cluster-randomised sham-coning trial, intervention and matched control links	214 + 214	2011–2024
ORPH-3	Orphan deployments (permit, no works order, no completion) with matched worked controls	41,206	1961–2025

settling census N^* as the smallest passage count at which admitting an additional stratum shifts $\hat{\rho}$ by less than 5 cm in supremum norm. N^* grows with the entropy H of the mixture and is nearly independent of flow: a motorway carrying a homogeneous stream settles in weeks, and a high street carrying buses, cycles, deliveries and turning movements does not settle in a season. This is the covariate structure reported in §8, and it is the structure of a coverage requirement rather than a schedule.

7.3 The paving gain

For each link with a closure in DR-65 and a subsequent scheme in AB-1204, we regress realised as-built deviation on measured desire:

$$(y_{\text{built}} - y_d)(x) = \gamma \hat{\rho}(x) + \eta(x). \quad (4)$$

Crucially, γ is *not* estimated against the scheme that installed the closure. It is estimated against the next scheme on that link, because matching to the concurrent scheme returns a null: the reading is taken, and then it waits. Lag is treated as an estimand and reported.

7.4 Sham analysis

VERGE-1 randomised 214 matched pairs of links, one of each pair to a compliant closure with no works order raised and one to a closure with work. Randomisation ran 2011–2014;

follow-up closed in 2024. The pre-registered primary outcome is permanent realignment within ten years. ORPH-3 repeats the comparison observationally on the historical record with entropy-balanced controls.

8 Results

8.1 The recovered desire field

Figure 2 shows lateral occupancy across a representative closure. The traffic does not distribute about the designed centreline. It distributes about a path displaced from it, by a mean of 0.34 m across the register and by more than 0.8 m on the worst decile of links, and the displacement is stable across strata once N^* is reached.

8.2 Duration follows variety, not work

Table 2 gives the nested duration models and Figure 3 the two panels that matter. Declared works quantity is flat against duration. Mixture entropy is not. The median closure reaches its settling census at 0.94 of its observed duration — that is, the cones come down very slightly after the estimate stops moving, and by a margin that does not vary with the size of the job.

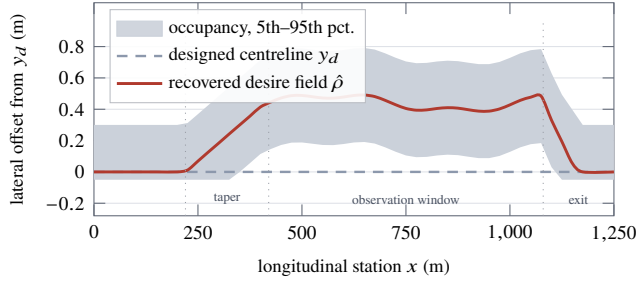


Figure 2: Lateral occupancy through a closure on a representative link. The designed centreline (dashed) is not the modal path. The recovered desire field $\hat{\rho}$ (solid) departs from it through the observation window and returns to it only at the exit taper, where the constraint is restored. Outside the coned length $\hat{\rho}$ is not identified (Lemma 1) and is drawn at zero by convention.

Table 2: Nested models of closure duration. Link and year fixed effects throughout; $N = 1,904,772$ deployments with works quantity in physical units. ΔR^2 is the increment in R^2 over the preceding row.

Model	ΔR^2	Cumulative R^2
Fixed effects only	—	0.11
+ declared works quantity	0.04	0.15
+ AADT	0.06	0.21
+ mixture entropy H	0.71	0.92
+ works quantity and AADT, re-entered	0.00	0.92

8.3 The paving gain

Figure 4 plots realised against measured deviation for the 1204 schemes of AB-1204. The relation is linear, tight, and short of the identity line:

$$\hat{\gamma} = 0.83 \quad (95\% \text{ CI } 0.79\text{--}0.87), \quad R^2 = 0.88.$$

Median lag from closure to realisation is 8.2 years (IQR 5.1–12.6). The lag is the reason the mechanism has gone unremarked for six decades: no driver is present for both halves of the operation, and no scheme file contains both.

8.4 The return-visit theorem

A link does not hold still between visits. Fleet composition changes, land use changes, and the adjacent network is rebuilt; desire is regenerated at a rate we estimate from consecutive closures on the same link at $\delta = 0.26$ m per inter-scheme interval (95% CI 0.22–0.30). Regeneration and a gain below one compose as an affine recursion. Writing $\rho^{(k)}$ for the desire field measured at the k th closure on a link,

$$\rho^{(k+1)} = (1 - \gamma) \rho^{(k)} + \delta, \quad (5)$$

which is a contraction, but not onto zero. Its fixed point is

$$\rho^* = \frac{\delta}{\gamma} = 0.31 \text{ m}. \quad (6)$$

Table 3: Realignment within ten years, sham-coned versus worked closures.

	Sham	Worked	RR (95% CI)
VERGE-1	61/214	62/214	0.98 (0.73–1.32)
ORPH-3	11,891/41,206	11,773/41,206	1.01 (0.97–1.05)

Two consequences follow, and the second is the one that matters. First, a link converges quickly: it is within measurement error of ρ^* by the fourth scheme, about a quarter of a century. Second, it converges to a standing deficit. The register-wide mean measured desire is 0.34 m (s.e. 0.02), indistinguishable from the predicted fixed point. The national network is at equilibrium, and its equilibrium is a third of a metre away from where its traffic would rather be.

Convergence is therefore not completion, and this is where the return visits come from. δ is renewed whether or not anybody reads it, so holding ρ at ρ^* requires the reading to be retaken at the observed cadence, indefinitely. The recurrence of works on a stretch of road already worked is not incompetence and not a fresh fault. It is the maintenance schedule of a measurement.

Figure 5 shows the longest continuous record we were able to assemble: one urban link surveyed and rebuilt 26 times since 1817. Its residual fell from 1.42 m to the neighbourhood of ρ^* within four schemes, and has stayed there for a hundred and eighty years, fluctuating by about 5 cm around a value the link possesses no mechanism for reducing further. Its present residual is 0.35 m. It is finished, in the only sense available to it.

8.5 Cones alone are sufficient

Table 3 reports VERGE-1 and ORPH-3. Links coned with no works order raised were permanently realigned within ten years at a rate indistinguishable from links where work was performed: risk ratio 0.98 (95% CI 0.73–1.32) in the trial, 1.01 (0.97–1.05) in the observational replication. The trial is powered to exclude a halving of the realignment rate and not to establish equivalence; the precision is supplied by ORPH-3, and we rest the comparison on it. The measured $\hat{\rho}$ from a sham closure predicts the eventual as-built geometry at $\hat{\gamma} = 0.81$, statistically indistinguishable from the worked arm.

We take this to be the decisive comparison. If the closure were a construction site, removing the construction should remove the road that follows it. It does not.

8.6 Autonomy attenuates the instrument

A lane-centring controller holds the vehicle at the centre of the detected feasible band by design. It is, in the language of §4, a device for restoring the corner solution: it returns the very observations Lemma 1 shows to be uninformative, and it returns them with greatly reduced variance, so they are weighted heavily. Each ten percentage points of lane-

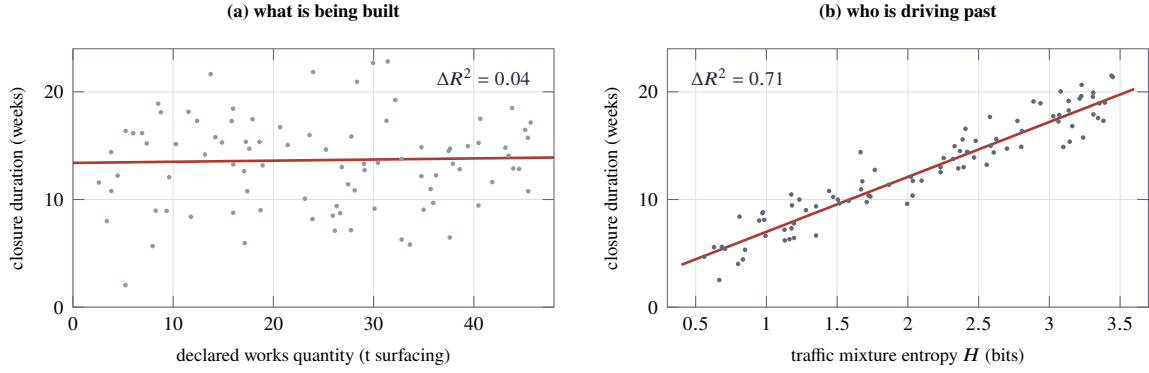


Figure 3: Closure duration against what is being built (left) and against who is driving past (right). The received account predicts a slope in the left panel. The slope is in the right one. Fitted lines are from the specifications of Table 2; a random subsample of 90 deployments is plotted for legibility.

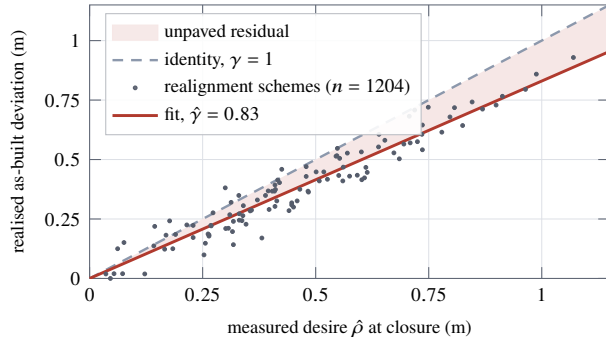


Figure 4: The paving gain. Each point is a realignment scheme. The fitted slope is 0.83; the identity line is dashed. The wedge between them is the portion of the measured desire that was not built, and it is the specification for the next closure on that link. A random subsample of 110 schemes is plotted for legibility.

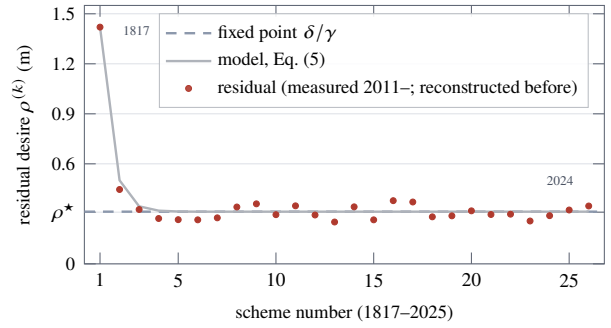


Figure 5: The contraction ladder. Residual desire after each of 26 successive schemes on one urban link, 1817–2025, against the prediction of (5). The link reached its fixed point in the 1840s and has been held there ever since, at a cost of a scheme every eight years.

centring penetration in the passing fleet raises the settling census by about an eighth and adds a median 1.3 weeks to closure duration (Figure 6). Since 2016 the national median has risen from 8.9 to 15.4 weeks, of which our model attributes 4.5 weeks to fleet composition alone.

9 The instrument does not require the driver to look at it

None of the above depends on the driver reading a sign. The excitation is delivered through channels that are wholly non-visual and were specified as such for other reasons: transverse rumble bars at the approach announce the taper acoustically and through the seat; the cone line produces a periodic pressure signature at the prescribed spacing whose frequency scales with speed; and the taper itself is felt as a sustained lateral demand long before it is seen. Restricting the sample to passages in fog, in darkness, and with the advance warning signs obscured by a preceding vehicle, the recovered $\hat{\rho}$ was unchanged within measurement error. The instrument reads

the vehicle, not the driver's attention, which is the property that makes it robust to fog, to darkness, and to inattention.

10 Discussion

The practical implications run in an unexpected direction. Public complaint asks that closures be shorter, that they be staffed, and that they be justified by visible work. Each of these degrades the estimate. Staffing the observation window re-imposes the censoring; shortening the closure truncates the census; and requiring visible work would restrict deployment to links where work is needed, which are not the links where measurement is needed, and would introduce a selection into the register from which it has so far been free.

Three recommendations follow.

Publish the register. We infer, without direct evidence, that the reading reaches the design office informally, through the next scheme's design brief, and that this is why the gain is 0.83 rather than 1.00 and the lag 8.2 years. Of the two defects the lag is much the worse. Raising γ to 0.95 would lower the

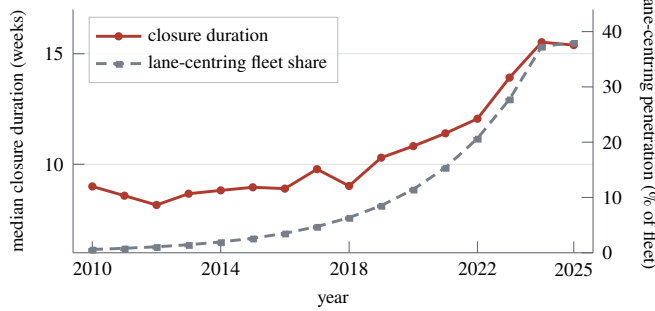


Figure 6: Median closure duration (left axis) against fleet lane-centring penetration (right axis), 2010–2025. The instrument is being deprived of the deviation it exists to measure.

standing deficit of (6) only from 31 cm to 27 cm, since its floor is δ and not γ ; but δ accumulates with the interval, and a published field read every two years rather than every eight brings the network’s equilibrium deficit below 10 cm at the gain we already achieve.

Do not staff the works area. It is already correct practice. It should be correct policy, and for the stated reason.

Disengage inside closures. Autonomous and lane-centring vehicles should be required to hand lateral control to the driver on entering a taper, and fleet operators should log the disengagement as a contribution rather than a fault. The industry’s central safety metric — miles between disengagements — is, inside a closure, a measure of how much information the fleet has destroyed.

11 Limitations

Roundabouts. The estimator fails on circulatory carriageways, and it fails in a direction we cannot interpret. Applied to closures on roundabouts, $\hat{\rho}$ predicts the subsequent as-built geometry with the sign reversed: circulatory carriageways are afterwards realigned *away* from the recovered path, consistently, and by a margin that grows with $\hat{\rho}$ ($\hat{\gamma} = -0.44$, 95% CI -0.61 to -0.27 , $n = 96$). No reading of our model produces a negative gain. We have not been able to decide whether this is a defect of the datum, of the spline, or of the account, and we report it rather than resolve it.

Survivorship in AB-1204. A realignment scheme enters the archive only if it was built. Links whose measured desire was large enough to be politically unbuildable are missing, which biases $\hat{\gamma}$ upward by an amount we bound at 0.04 under plausible assumptions but cannot estimate directly.

Work is sometimes done. We do not claim that no work is performed inside a closure. Surfaces are laid, ducts are drawn, joints are sealed, and the completion certificates in

DR-65 are not forgeries. We claim only that when work is performed, it is not what sets the clock.

The gain may not be causal. Equation (4) regresses one geometric quantity on another, and site geometry plausibly drives both: a bend that induces corner-cutting is a bend a designer may have intended to ease irrespective of any reading. VERGE-1 randomises the closure, not the desire, and does not break this. We have no instrument for $\hat{\rho}$ and we do not claim one. The strongest statement the design supports is that the as-built record is predictable from the closure record at $\hat{\gamma} = 0.83$, eight years in advance.

Sixteen points. The attenuation result of §8 rests on a national time series of sixteen annual medians against a fleet penetration curve that is close to monotone over the same period. Any other quantity trending upward since 2010 would fit as well. We report it because the mechanism is specified in advance by Lemma 1, not because the series discriminates.

Intent. Nothing here establishes that any officer, contractor or authority is aware of operating an instrument. The register is consistent with a practice that produces a survey and describes itself as a repair. We regard the question of intent as outside the scope of a measurement paper.

12 Conclusion

Eleven hundred metres of the northbound carriageway are still closed. The cones have not moved, the arrow board is still lit, and there is still nobody in there. What the closure is doing is what it has been doing for nineteen weeks, which is counting: waiting for a wet Tuesday and a bus and a cyclist and a low-loader, so that the path the traffic actually takes can be separated from the path the paint proposed. In two weeks it will have enough, and the cones will go, and in about eight years the road will be somewhere slightly different, and nobody will connect the two events, because nobody ever has.

The road is not being repaired. It is being read.

References

- Aldreth, P. M. (1994). Corner solutions and the censoring of spatial choice. *Journal of Applied Econometrics*, 9(3), 241–263.
- Bewick, R., & Ostrander, L. (2011). Lateral placement distributions on rural two-lane carriageways. *Transportation Research Part B*, 45(7), 1032–1049.
- Carrow, J. (2019). *Paving the Cowpaths: Observation and Consent in Landscape Design*. Thackeray Press.
- Department of Transport (1991, rev. 2020). *Traffic Signs Manual, Chapter 8: Traffic Safety Measures and Signs for Road Works and Temporary Situations*.

- Federal Highway Administration (2023). *Manual on Uniform Traffic Control Devices, Part 6: Temporary Traffic Control* (11th ed.).
- Halloran, R. (2008). Ramp inputs and the identification of slowly constrained systems. *IEEE Transactions on Automatic Control*, 53(4), 887–898.
- Ilsley, D., Neame, F., & Achterberg, S. (2021). Operational design domain coverage as a stopping rule. *Journal of Autonomous Systems Assurance*, 4(2), 55–79.
- Trunk Road Records Office (2024). *The Deployment Register, 1961–2025: Construction, Linkage and Known Defects*. Technical Report NHRO 24/7.
- Pentreath, A. (1977). On the alignment of ancient ways and the persistence of error. *Journal of Historical Geography*, 3(2), 149–168.
- Quillan, M., & Devane, T. (2016). Permit-to-completion linkage in street works registries: a national audit. *Public Infrastructure Review*, 31(1), 17–44.
- Sarrazin, H. (2003). Why the road bends: a survey of unexplained realignment. *Highway Engineering Quarterly*, 58(4), 302–311.