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The RICS COBRA Conference is held annually. The aim of COBRA is to provide a platform for the dissemination of original research and new developments within the specific disciplines, sub-disciplines or field of study of:

Management of the construction process

- Cost and value management
- Building technology
- Legal aspects of construction and procurement
- Public private partnerships
- Health and safety
- Procurement
- Risk management
- Project management

The built asset

- Property investment theory and practice
- Indirect property investment
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- Urban development
- Planning and property markets
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- The dynamics of residential property markets
- Global comparative analysis of property markets

- Building occupation
- Sustainability and real estate
- Sustainability and environmental law
- Building performance

The property industry

- Information technology
- Innovation in education and training
- Human and organisational aspects of the industry
- Alternative dispute resolution and conflict management
- Professional education and training

Peer review process

All papers submitted to COBRA were subjected to a double-blind (peer review) refereeing process.

Referees were drawn from an expert panel, representing respected academics from the construction and building research community. The conference organisers wish to extend their appreciation to the following members of the panel for their work, which is invaluable to the success of COBRA.

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Vivien Wing Yan	Chow	University of New South Wales
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Patrick	Daly	BESRAC

In addition to this, the following specialist panel of peer-review experts assessed papers for the COBRA session arranged by CIB W113

John Adriaanse	London South Bank University, UK
Julie Adshead	University of Salford, UK
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Operating the renewed school estate – an empirical insight into cost and PFI

Andrew Edkins, Graham Ive¹ and Alex Murray

The Bartlett School of Construction and Project Management,
London, WC1E 6BT, United Kingdom

Email: andrew.edkins@ucl.ac.uk; g.ive@ucl.ac.uk; alex.m.murray@ucl.ac.uk

Abstract:

The use of the Private Finance Initiative (PFI) as a procurement method for capital schools projects over the past decade has been considerable, and a controversial issue. The relevance of procurement method on the operational performance of projects and facilities is an area cited as needing more research by amongst others the National Audit Office. Recently, the relative benefits of rebuilding versus refurbishment have also become an issue, especially in the context of cancellation of the Building Schools for the Future programme, and the James Review of how to get better value from likely decreasing total capital expenditure on schools. In attempting to fill this knowledge vacuum, this study presents comparative samples of normalised expenditures post-renewal on facility services costs in renewed English comprehensive secondary schools. Data is presented in elapsed time relative to year of school renewal, sampled to produce early facility life cost profiles up to a maximum of 9 elapsed years by both procurement method (PFI and Non-PFI), and type of capital works (refurbishment and new / re-build). The results include that total facility services costs in PFI schools are higher (though not significantly) in six of the nine elapsed years. Total facility services costs are broadly similar over the nine elapsed years following renewal in rebuilt and refurbished schools. The influence of procurement method on expenditure on certain facility services, coupled with high correlations between procurement method and type of capital works, prevents clear conclusions on the independent impact of type of capital works on operational expenditure. As expected, higher expenditures on building maintenance and improvement are witnessed in PFI samples in certain years, in line with life cycle financial modelling principles.

Keywords:

operational cost, PFI, renewal, schools, whole life cost.

1 Introduction

This paper is an empirical study of the on-going facility related operational expenditures of renewed secondary comprehensive schools within England. The analysis seeks to benchmark objectively the operational expenditures of such schools according to:

the procurement route that led to the school's renewal, i.e. via the Private Finance Initiative (PFI) route or not;

the form of renewal undergone, including 'new build', 're-build', 'refurbishment', 'partial refurbishment'¹.

The cancellation of Building Schools for the Future (BSF) capital investment programme leaves the issue of a deteriorating school estate unresolved. Lack of national school condition data² means we have no objective data with which to measure either:

change in the overall condition of the estate, on average or as a distribution;

or, specifically, to measure condition in the renewed schools examined here

¹ The form of renewal is as given in the School Building Surveys of 2007 and 2009.

² On this lack, refer to the James Review discussed later.

‘Performance’ of renewed schools can in principle cover everything from educational outcomes to quality of current FM services and asset condition. This paper only looks at FM cost, but is an output from a research project looking at both cost and performance.

The ultimate funding of state provided comprehensive education is always by the taxpayer. However, over the past decade, the use of the PFI to finance upfront investment in schools has been considerable. According to the latest HM Treasury PFI signed project list of March 2011 (HM Treasury, 2011), the Department for Education (DfE) has 162 PFI projects (134 in operation, 28 in construction). The estimated capital value of these 162 projects is £7.76bn. The vast majority of these projects are in fact schools projects, but will include primary as well as secondary schools. In part due to the high transaction cost of arranging PFI projects, and the relatively low capital value of a single school, many PFI projects provide for the construction and maintenance of numerous separate schools within one bundled contract.

It is evident that a considerable amount of the recently renewed school estate is under the regime of PFI construction and operation. This paper seeks to benchmark the operational service expenditures of these schools with comparable recently renewed Non-PFI schools to shed light on relative cost attributable to procurement method.

The School Building Surveys (SBS) of 2007 and 2009 reveal fewer than 15% of comprehensive secondary schools have undergone capital works greater than 50% refurbishment during the period 1992 – 2008. There remains a vast estate in need of investment to reduce a considerable yet uncertain backlog maintenance.

1.1 Aims and objective of this research

The aim of this research is to contribute to a more solid evidence base for the on-going debate concerning the cost and performance of privately financed public infrastructure. The ability to compare the operational cost and performance of social and economic infrastructure by the procurement method applied is an area cited by the National Audit Office (NAO) as requiring work: “We have yet to come across truly robust and systematic evaluation of the use of private finance built into PPPs at either a project or programme level. The systems are not in place to collect comparable data from similar projects using different procurement routes. Unless such systems are established, together with robust evaluation of the overall whole-life costs of alternative forms of procurement, Government cannot satisfy itself that private finance represents the best VFM option.” (Private Finance Projects – A Paper for the Lords Economic Affairs Committee, National Audit Office, 2009b, page 8.)

We sought to help remedy this through sourcing data that is both objective and appropriately comparable. It is expected the audiences that might benefit from this research include private contractors seeking to benchmark their contract performance, as well as public policy makers considering the future of PFI as a procurement method. Some findings of this research were included in evidence submitted by the authors to the Treasury Committee’s 2011 inquiry on the Private Finance Initiative.

2 Theoretical framework and recent insight

The theoretical framework is in part based on the notion of incomplete contracts and private information (Hart et al. 1997; Hart, 2003). Under a PFI contract, specified standards of operational performance must be achieved for the Special Purpose Vehicle (SPV) providing the service to avoid financial penalties. A specified standard of output implies a certain level of expenditure on inputs. It is proposed that this expenditure can take one of three forms, the first being a form of capital expenditure (CAPEX), the later two being subsets of operational expenditure (OPEX):

Upfront CAPEX – leads to a better built or higher specification asset

Annual maintenance – frequent observation and non-capital upkeep expenditure

Life cycle replacement – infrequent renewal of elements of the asset

It has been proposed that combining the design, build and operation (DBO) of a facility into one contract, as in PFI, promotes the optimisation of a whole life cost (WLC) approach, potentially resulting in lower operational expenditures (Hart *et al.*, 1997; Rintala, 2004). That is, there is an option of substitution between the three expenditures above with, in theory, an associated optimum lowest level of total expenditure (in present value terms) able to provide the contracted standards. This optimisation can be considered as the internalisation of a positive externality (Bennett and Iossa, 2006), the externality being the potential for WLC savings when there are separate contracts for D, B and O. This stands whether the investment in lower WLC is verifiable or not, and, as the incentive for this is internalised within the Special Purpose Vehicle (SPV) delivering the project, no bargaining with the public client for such investment is required.

In providing the SPV with a certain enough context in which to realise minimised WLC throughout a 25-year contract, there is a trade off in the flexibility of provision (HM Treasury, 2008; NAO, 2008).

Some question the ability of PFI to deliver efficiency gains in sectors where the quality of the infrastructure can not feasibly significantly reduce operational cost, as it can in transport and water (Iossa & Martimort, 2008).

Furthermore, it is not just the bundling of the contract that is relevant, but the ownership of the asset. This matters especially when investment cannot be verified (Hart *et al.*, 1997). Placing the asset's ownership within the SPV further incentivises optimal WLC investment to ensure the asset value (in terms of meeting contractual standards and the resulting revenue stream) is maintained.

In theoretical terms, the public sector client cannot observe the investment of effort expended by the SPV, which is therefore said to have private information. There are two types of investment a SPV can make, as discussed by Hart *et al.* (1997). These include effort spent on efficiency enhancing innovations as well as effort spent on ways to cut cost through shading quality. It is acknowledged that the freedom to innovate and realise WLC has a downside. In this regard, it is anticipated that a well enough specified contract would hinder the ability to shade on quality of operational performance.

To use this theoretical framework, we distinguish 'contractable build quality' from 'design quality' (Ive and Chang, 2007). The former is contractable because it impacts on measurable operational performance or asset durability, and these measures can in turn be linked to payment under the contract.

Given the PFI payment mechanism, we hypothesise that:

SPVs will trade-off capital expenditures on design quality for those on contractable build quality, resulting in higher levels of the latter (than in Non-PFI schools) per unit of CAPEX. This will tend to reduce required OPEX on maintenance and replacement.

The relatively high discount rate SPVs will use in investment decisions, taken together with their ability to commit to levels of maintenance and replacement expenditure, will lead them to spend more on operation relative to CAPEX.

Greater total budgets available for PFI projects than for Non-PFI would result in clients specifying higher standards of operational performance. This would induce SPVs to spend more on OPEX.

Whether OPEX will be higher or lower in PFI than in Non-PFI schools will therefore depend on: (i) their relative CAPEX budgets, and (ii) the relative strength of effect (A) versus (B) and (C).

The relevance of this theoretical framework in this study, driven by the principles of WLC, is limited by the completeness, scope and maturity of available data. We have not been able to control for CAPEX or asset condition of operational facility as yet.

2.1 Recent insight

Little work has been done that compares objective measures of operational cost and performance across methods of procurement. The NAO has made extensive studies of PFI procurement during the construction phase (NAO, 2009a; NAO, 2003), which find that PFI tends to perform better in terms of delivery time and being on budget. There has been one NAO study of the performance and

management of PFI hospital contracts. This study found ‘the cost and performance of PFI hotel services are similar to those in Non-PFI hospitals’ (NAO, 2010, pg. 6).

A similar study to the present one, using central datasets, concerning the provision of soft FM cleaning and catering services found no significant difference in cost between new PFI and new Non-PFI hospitals (Ive et al., 2010). Of the 4 years observed, there were however instances of statistically significant higher performance levels in terms of higher patient environment ratings, NHS cleanliness scores and food ratings. The data on aspects of hard FM was not of sufficient quality to draw conclusive insight.

The James Review of Education Capital (James, 2011) notes the potential for standard designs and specifications in reducing WLC, through common material specification and lower energy use. The review does not contain similar discussion of the potential for integrated and incentivised contracts. Perhaps an indication the government may not be planning to continue to advocate use of PFI for schools projects.

3 Research method

The aims and objectives of this research were achieved by accessing an official data source¹ of commonly specified public expenditures for all schools. Other reliable public data sources² were then used to develop the elapsed time profile from renewal, and to identify and extract comparable samples of PFI and Non-PFI schools.

3.1 Sampling schools

The sampling and analysis was performed during the summer of 2010 with the most recent available data as it was then. The core sample of renewed schools was created through the following process:

A complete list of over 65,000 educational establishments in England and Wales was obtained from the DfE³. The number of secondary schools within the dataset was 4,225. The dataset was filtered by admission type to include only comprehensives. That left 3,188 schools⁴.

We then cross-matched the 3,188 schools with the SBSs of 2007 and 2009⁵. This identified which schools had received significant capital works amounting to ‘renewal’ between financial years 1992/93 and 2007/08. This included some 403 schools.

A very small number of schools had inconsistent data between the SBS of 2007 and 2009. The data was verified from external sources such as school websites and most such schools were retained in the core sample:

Five schools were removed from the sample as SBS of 2007 and 2009 contained conflicting information;

Two schools which appeared to have been renewed twice were removed from the sample;

One anomalous school was found to be an Academy and was removed.

The remaining 395 schools formed the core sample. 133 were identified as being PFI schools according to a field within the initial Edubase.gov dataset of educational establishments. The remaining 262 are considered Non-PFI.

9 samples were made, one for each elapsed year from each school’s renewal.

¹ Consistent Financial Reporting dataset maintained by the Department for Education.

² SBSs 2007 & 2009 and the Edubase.gov educational establishment datasets.

³ Refer to www.edubase.gov.uk

⁴ Other admissions types excluded included ‘selective’, ‘modern’ and ‘N/A’. This step also removed Academies as well as Welsh establishments from the sample, as they did not have sufficient admission type data.

⁵ Survey undertaken by DfE, completed and by local authorities and provided to us by Partnerships for Schools.

3.2 Expenditure variables

These comparative samples were then used to retrieve the associated expenditure data for each school in accordance with the process below:

The Consistent Financial Reporting (CFR) dataset for financial years 2002/03 to 2008/09 was obtained from the DfE. There is thus a maximum of seven years cost data potentially available for a specific school, if it was renewed before 2002/03; reducing to a minimum of one year if it was renewed in 2007/08.

From the range of available expenditure lines, an operational cost basket was created. The basket is not exhaustive of all services provided within a school, but we believe it includes the core soft and hard FM¹ services typically included within the scope of a school PFI contract. The components of the basket, and corresponding CFR reference for clarity, include²:

Building maintenance (E 12);

Grounds maintenance (E13);

Cleaning and caretaking (E14);

Premises staff - in-house caretakers and other similar staff (E04);

Bought in professional services - inc. PFI management fee (E28);

Catering supplies - including contracted catering services (E25);

Catering staff - capturing in-house catering staff (E06);

ICT learning resources (E20).

Expenditures were converted to constant April 2010 prices using RPIX data from the Office of National Statistics. The expenditures for each school were divided by the school's pupil capacity³ for normalisation.

Data for each school were rearranged into elapsed time from that school's renewal using the year of capital works from the SBS as a point of reference.

The cost data were sampled separately for each of the nine elapsed years after opening of a renewed school facility. A school was only included in the analysis if it had returns for all eight of the operational cost expenditure lines identified above. This was an attempt to minimise the possibility of bad reporting between expenditure lines and cleanse the sample of inaccurate observations.

The final combined actual sample sizes vary from 73 in Year 9 to 203 in year 2.

3.3 Procurement samples – PFI versus Non-PFI renewed schools

The core sample of 395 schools was divided into 133 PFI and 262 Non-PFI schools with reference to a field from the original list of all educational establishments, which indicated if a facility was under a PFI arrangement.

Works type samples – Rebuilt versus refurbished schools

To produce comparative samples for type of capital works, the core sample of 395 schools was divided into 193 rebuilt and 202 refurbished schools. Rebuilt refers to facilities listed in SBS's as either 'new build' or 're-build', and refurbished refers to schools listed as either '80% - 100% refurbishment' or '50% - 80% refurbishment'.

3.4 On statistical testing

Independent sample two-tailed t-tests at 95 percent confidence were used for annual comparisons of total basket expenditure. When interpreting the results, if Levene's test for equality of variance found significance, the *equal variance not assumed* p-value was used. If there is no correlation between the consistency of data reporting from the school and levels of expenditure, then the

¹ Hard FM is typically understood to include the management and maintenance of the core fabric of the building. Soft FM services are those pertaining to the management and provision of services provided within the building, e.g. cleaning and catering.

² Detailed descriptions of what each expenditure line includes can be found on the School Financial Benchmarking website: <https://sfb.teachernet.gov.uk/Assets/metrichelp.htm#I01>

³ Provided in the initial Edubase.gov dataset of educational establishments in England and Wales.

samples can be considered random samples and applicable to inferential statistical analysis. As we come to understand the data more, we will develop more descriptive statistical techniques.

3.5 Comment on accounting of expenditure

Looking at the definitions of the expenditure lines within the CFR data, the soft and hard FM expenditure lines for PFI schools refer to contract payments. The amounts allocated here will represent the amount paid by the public authority for the associated service as part of the larger Unitary Charge Payment (UCP) for the complete contract.

4 Findings and Discussion

The main findings from the analysis include:

Average total expenditures on the basket of FM related services are higher for PFI school samples in six of the nine elapsed years observed. Non-PFI expenditures are higher in three years. None of the differences of means are statistically significant¹.

As expected, we observe higher levels of *Building maintenance (E12)* expenditures in PFI schools from year 5 onwards, in line with planned life cycle expenditures.

The *Bought in professional services (E28)* expenditure line is consistently higher in PFI schools. This is as expected as this includes the PFI management fee. There is a considerable increase here going into year 7 of operation. We propose that this is the costing of the contractually obligatory benchmarking and market testing exercises being passed on to the public sector through the PFI management fee.

The level of variance differs significantly between samples. Further work is needed to apportion and explain much of this.

4.1 Procurement type data

Table 1: Operational cost breakdown by category for years following renewal
(£s per pupil capacity) – Non-PFI schools

<i>Years following renewal</i>	1	2	3	4	5	6	7	8	9	<i>9 year unweighted average</i>
Sample size	112	135	119	124	109	98	89	65	60	
<i>Building maintenance</i>	97	96	82	85	77	73	81	80	85	84
<i>Grounds maintenance</i>	13	16	14	13	14	14	13	14	14	14
<i>Cleaning and caretaking</i>	53	55	54	56	56	54	54	55	55	55
<i>Premises staff</i>	107	112	112	116	116	120	118	122	119	116
<i>Bought in prof. services</i>	40	58	58	40	47	49	46	45	57	49
<i>ICT learning resources</i>	68	65	62	67	64	70	75	65	80	68
<i>Catering supplies</i>	65	73	76	75	82	80	77	78	74	76
<i>Catering staff</i>	16	17	18	17	17	23	21	29	29	21
Total	459	493	476	469	473	483	485	489	513	482

Table 2: Operational cost breakdown by category for years following renewal
(£s per pupil capacity) – PFI schools

<i>Years following renewal</i>	1	2	3	4	5	6	7	8	9	<i>9 year unweighted average</i>
Sample size	62	72	77	62	44	33	26	16	13	
<i>Building maintenance</i>	97	95	73	99	121	164	149	216	157	130
<i>Grounds maintenance</i>	18	17	12	12	11	15	10	9	9	13
<i>Cleaning and caretaking</i>	59	67	67	61	64	62	57	73	96	67
<i>Premises staff</i>	47	14	16	16	12	11	12	12	3	16

¹ A significant result with assumed equal variance in year 7 is rejected because the Levene's test for equality of variance result is strongly significant.

<i>Bought in prof. services</i>	121	173	152	138	132	153	238	110	80	144
<i>ICT learning resources</i>	110	91	69	79	91	103	62	75	58	82
<i>Catering supplies</i>	68	55	51	60	62	64	70	61	52	60
<i>Catering staff</i>	6	3	3	1	2	2	3	5	4	3
Total	525	516	445	465	494	573	600	561	459	515

Combined sample size	174	207	196	186	153	131	115	81	73
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4.2 Works type data

Table 3: Operational cost breakdown by category for years following renewal (£s per pupil capacity) – Refurbished schools

<i>Years following renewal</i>	1	2	3	4	5	6	7	8	9	<i>9 year unweighted average</i>
Sample size	101	117	98	100	85	75	62	41	38	
<i>Building maintenance</i>	115	120	89	99	95	87	96	78	86	96
<i>Grounds maintenance</i>	16	21	15	14	13	14	13	13	12	15
<i>Cleaning and caretaking</i>	55	58	62	58	59	57	56	63	63	59
<i>Premises staff</i>	98	102	102	110	104	108	116	116	111	108
<i>Bought in prof. services</i>	61	67	60	51	48	53	55	41	56	55
<i>ICT learning resources</i>	74	68	62	66	60	71	68	62	83	68
<i>Catering supplies</i>	72	80	76	78	79	80	77	76	77	77
<i>Catering staff</i>	13	14	13	15	12	21	22	30	26	18
Total	504	530	480	491	469	492	504	477	514	496

Table 4: Operational cost breakdown by category for years following renewal (£s per pupil capacity) – Rebuilt schools

<i>Years following renewal</i>	1	2	3	4	5	6	7	8	9	<i>9 year unweighted average</i>
Sample size	73	90	98	86	68	56	53	40	35	
<i>Building maintenance</i>	71	64	68	78	83	108	96	137	110	91
<i>Grounds maintenance</i>	13	11	11	11	12	15	12	13	14	12
<i>Cleaning and caretaking</i>	55	61	56	57	58	55	54	55	62	57
<i>Premises staff</i>	69	47	46	51	64	72	69	84	86	65
<i>Bought in prof. services</i>	81	138	130	98	101	103	129	76	67	103
<i>ICT learning resources</i>	96	82	68	77	87	88	76	72	69	79
<i>Catering supplies</i>	58	50	57	61	73	70	72	74	62	64
<i>Catering staff</i>	11	9	11	8	12	13	12	18	22	13
Total	454	463	447	441	492	524	520	530	492	485

Combined sample size	174	207	196	186	153	131	115	81	73
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4.3 Discussion

It should be noted that there is considerable correlation between a school being rebuilt and a school being procured through PFI. Around 80% of the rebuilt sample, but approximately 33% of the total sample, comprises of PFI facilities. This provides further insight into the previous findings from procurement cost profiling. It is therefore reasonable to assume that the sample of PFI facilities may have incurred higher up front capital cost, not only because of the incentivisation for lower whole life cost encouraging high specification build, but merely because within these samples, PFI facilities comprise of more new builds and rebuilds, and less refurbishments.

The cancellation of the BSF programme along with notably minimal referencing to the terms ‘finance’ or ‘PFI’ within the James Review, suggests the future scope of PFI capital investment in the school building stock is limited. The current financial structures imposed by the UK government

have clearly signalled the cessation of major renewal programmes for social infrastructure assets such as schools. Along with a political desire to encourage more local decision-making, this financial challenge suggests schools will see smaller and more specific alterations and improvements.

5 Conclusion and Further Research

We believe this is the first study of its kind for the UK. It uses officially collected data on cost and operation of a large portion of the school estate, to inform objectively the debate concerning the relative costs of alternative procurement methods. Using the best publicly accessible data, it has been shown that no years of operation witness statistically significant differences in average total FM basket expenditure between PFI and Non-PFI samples.

Furthermore:

In contrast to the near flat Hard FM expenditure observed in Non-PFI facilities over the first 9 years of operation, PFI facility operators are observed to sustain higher hard FM expenditure from years 5 to 9;

There is significant increase in the *Bought in professional services* expenditure line in PFI facilities from year 6 to 7. We propose that this is explained as the result of PFI operators passing on the cost of benchmarking and market testing activities within the PPP management fee.

In conducting this research, significant time was spent attempting to find data on the physical condition of the built infrastructure. Neither the SBS of 2007 or 2009 asked that an objective metric indicating the condition of the building be provided. Ofsted reports do not provide data on the condition of the physical building, though they do provide assessments of the 'learning environment'. We considered this as an inappropriate proxy for asset condition.

Recommendation 8 of the James review reads:

"That the Department: gathers all local condition data that currently exists, and implements a central condition database to manage this information; Carries out independent building condition surveys on a rolling 20% sample of the estate each year to provide a credible picture of investment needs, repeating this to develop a full picture of the estate's condition in five years and thereafter."

(James Review of Education Capital, The Department of Education, April 2011, pg. 50)

The authors wholeheartedly support the establishment of common indicators of asset condition on the principle of 'what gets measured, gets managed'. Subject to this recommendation being enacted, we propose to revisit this analysis in future years. We are concerned that in an era of austerity and cost cutting, the collection and collation of the data necessary for such analysis will be reduced or even stopped. We urge policy makers to resist such temptations.

We have yet to develop a robust capability to control for capital expenditure. Some data is accessible but further work and consideration is required to establish a method.

Further planned research to build on this work includes:

Development of a parsimonious regression model to estimate significance and size of variable coefficients in determining soft and hard FM expenditure

Development of a method to incorporate the relevance of initial capital expenditure

Identification of an indicator to control for school building condition

Incorporation of actual numbers of pupils on roll each year, as opposed to pupil capacity, to better normalise the figures

Testing additional variables as available to improve accuracy of comparisons.

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