

Wholesale Price Index and its effect on Price Escalation of materials for Indian construction industry

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Abstract

For defining economy of the country, units contributing to it viz. goods and services traded in the economy are supervised indicated through various indices drafted by concerned authorities on the basis of retail, wholesale or producer prices of the goods. Indian economy follows wholesale price indices (WPI) compiled at national level which is a measure of wholesale price movement for the economy. Escalation with reference to construction industry is one of the major dispute prone clauses. Standard Indian construction contract conditions provide for calculation of escalation amount for materials using relevant WPI. Amount of change in WPI over a span of time affects the amount of escalation calculated. This paper studies the current structure of calculation of wholesale price index, identifies construction materials considered in the commodity basket, variation in WPI of these materials and its effect on arriving at escalation amount.

Keywords: Escalation, price indices, construction materials

instability reflects in adverse effect on prices of commodities. Thus variations in economic conditions are needed to be monitored. A statistical measure to assess changes in the economy is provided through various indices. In a financial market, an index is an imaginary portfolio of commodities representing a particular market or a portion of it.

With the advancement of science, technology and increase in industrialization, the demand for developmental projects has increased. Major outlay of the budget is spent on construction industry, hence it is of utmost importance to have close control on its cost and time management while achieving quality standards for the construction projects. Construction sector largely depends upon resources such as materials, machinery and labour which are the major cost drivers of construction projects. Variations in costs of these items of work as a result of variation in overall economy of the nation, affects the budget of a construction project adversely. This price rise is referred to as escalation in construction contract documents. The relation between escalation and related price indices is studied in this paper.

1.0. Introduction

The economy of India is the twelfth in the world by nominal GDP and the fourth largest by purchasing power parity with share of global GDP of 5.84%. In India, the highest growth rate was recorded in the mid-2000s, and is one of the fastest-growing economies in the world. Large instability exists in an economic system. This

1.1. Price escalation

Escalation is a phenomenon of economics reflected through rate of inflation computed from WPI data. Escalation is the change in cost or price of specific goods or services in a given economy over a period. Inflationary trends in economy get reflected through escalation in prices of units. It is the increase in the cost of any construction elements of the original contract or base cost of a

project due to passage of time [10]. John Hollmann et. al. (2007) [8] defines escalation as changes in price levels driven by underlying economic conditions.

Escalation affects the budget and causes severe financial overrun by the contractor. It also adds to contingency in the contractor's bid and is a major contributor to the overall cost uncertainty of 'escalation' in his tender rates from the employer. Construction work is carried out according to the pre-confirmed contract agreement. To cope up with the sudden price escalation, regulated provision is necessary in construction contract document.

1.2. Construction contract and claims

Contract terms and conditions play a dominant role in proper and timely execution of works, preventing and resolving disputes arising thereto [7]. Conditions of contract guide the involved parties regarding their rights, obligations, responsibilities and procedures to be followed. Drafting a construction contract is nothing but allocation of risks involved in a project among the parties to the contract [5]. Irrespective of all the provisions in the contract document, claims are raised on a construction site. Claims generally arise when one party to the contract suffers a detriment for which that party needs to be compensated by the other party [9]. It may be defined as a legitimate request for additional compensation on account of a change in the scope of project. Possibility of escalation over the period of execution of project leads to claim for escalation amount in addition to the base cost. Claims when not properly sorted lead to disputes.

To cope with the possibility of changes in economic conditions reflected through fluctuation in the cost of items and to make a provision for fair reimbursement of the escalation cost to the contractor who bears the extra cost, regulated escalation clause in the law or conditions of construction contract is necessary. Construction contract conditions drafted by central public works department (CPWD), India, contain provision for calculation of escalation in prices of construction materials for compensating the contractor.

2.0. Price index

The price index is an indicator of the price movements of fixed basket of commodities over time. A cost index provides a comparison of cost or price changes from period to period for a fixed

the project execution especially in projects in which variability and uncertainty is greater. Due to frequent rise in the prices of materials and wages of labour, the contract rates of the various items of work are affected adversely for the contractor who could not visualize such a steep rise and therefore could not include the same in his tender rates. Under such circumstances, the contractor claims quantity of goods or services [11]. Rate of inflation is an important measure to monitor economic fluctuations which is based on the movement of these indices. Rate of inflation is the rate at which the general level of prices of goods and services rise. Inflation is a continual increase in prices throughout a country's economy. The behaviour of the economy is cyclical and hence the pattern of change in the indices cannot be estimated accurately. Various price indices followed by different countries are wholesale price index (WPI), producer price index (PPI), consumer price index (CPI). As the name suggests, WPI considers prices of goods at wholesale level, PPI at the producer's end and CPI at consumer level.

2.1. Wholesale price index (WPI)

WPI is an index that measures and tracks the changes in price of goods in the stages before the retail level i.e. at the wholesale market level [2]. Government of India uses wholesale price index to monitor the changes in the average price level of goods traded in wholesale market from period to period. The purpose of WPI calculation is to monitor price movement serving as an important determinant in formulation of economic policies of the nation. This index is used for the purpose of escalation clauses in the supply of materials and machinery in construction works [1]. WPI is calculated on the basis of quotations of various items received at a regular interval of time. The items to be considered for calculation are decided based on market study, demand, supply, consumer behaviour etc. In India, since January 1942 i.e. introduction year of WPI, the series has undergone number of constructive changes.

2.2. Need of revision of the series of WPI

As stated earlier, economies undergo enormous changes over time. Liberalization in India has added to it which is quite evident from the pace of these changes. As a result of this, the market keeps on changing and updating with addition of newer materials and removal of

obsolete ones. A relatively fixed set of consumer products and services valued on an annual basis to track inflation in a specific market or country is a commodity basket. Thus the changes need to be incorporated in the commodity basket for the computations for WPI to be more effective, precise and indicative of the present economic

situation. History of WPI in India is representative of this phenomenon with overall seven revisions of the series of commodities to incorporate the dynamic changes in market. It has been a practice since then to revise the series after every decade. The revisions in WPI series in India till date are compiled in Table 1 below.

Table 1. Revisions in WPI series in India

Sr. No.	Base year	Year of introduction	No. of commodities	Groups of commodities	No of quotations
1)	August, 1939	Jan, 1942	23	4	23
2)	End of August, 1939	1947	78	4	215
3)	1948-49	1952	112	5	555
4)	1961-62	July, 1969	139	7	774
5)	1970-71	Jan, 1977	360	3	1295
6)	1981-82	July, 1989	447	3	2371
7)	1993-94	April, 2000	435	3	1918
8)	2004-05	Sept, 2010	676	3	5482

Hence, the commodity basket is tentative. Some of the items may have to be deleted, and the nomenclature of some of the items may have to be altered or new items may have to be included, depending on the availability of prices for the items selected for the new series basket and findings of the field survey on the nomenclature used in the new product basket [3].

3.0. Calculation of WPI

Each index has its own calculation methodology and definition of terms and is expressed in terms of a change from a base value. The commodity basket forms the basis of computation of WPI as it is said to represent the overall market. Once the basket is fixed, transactions of the items in the basket in a given economy are surveyed and recorded. Price quotations for the same items are collected from various vendors. Based on this information further calculations are carried out as follows.

Allocation of weights

Value of output is the value of transactions carried out in domestic market at first point of bulk sale. Weights are assigned to the commodity on the basis of its share in the total value of output in the economy. The weights of individual commodities

are represented as a percentage of total value which when summed up equals 100. These weights are used in calculation of index for all commodities. For items added newly, weights are revised for existing items. Weights of items to be removed are adjusted among other group members.

Calculation of price relative

Prices are collected for those items which are selected in the WPI basket from selected sources for data collection. Minimum 5 quotations per item are desirable whereas lesser number due to unavoidable circumstances is also acceptable. Price relative is the ratio of current price and base price of the commodity. Price relative is calculated for each quotation. Price quotations for commodities enable calculation of price relative which is calculated as follows:

$$\text{Price relative} = (\text{Current price} / \text{Base price}) * 100$$

Calculation of Index

Average of price relatives for all quotations for a given commodity gives the WPI for that particular item. Method of compilation of index follows Laspeyres's formula based on weighted arithmetic mean which is as follows:

$$I = (\sum(I_i X W_i)) / (\sum W_i)$$

Where,

I = Index number of wholesale prices of a subgroup/group/major group/ all commodities

I_i = Index for ith commodity in the subgroup/group/major group

W_i = Weight assigned to the item/subgroup/group/major group within the subgroup/group/major group/basket.

4.0. Materials in commodity basket

Commodity basket, as the name suggests, is a basket comprising of all commodities selected for calculation of WPI. It is basically a subset of products that is designed to mimic the performance of an overall market. The goods in the basket are often adjusted periodically to account for changes in consumer habits. Series 2004-05 contains total 676 items against 435 items in the previous series 1993-94. 259 items are common among these series. 176 items out of total 435 from series 1993-94 are deleted and total 417 new items are included in the commodity basket of series 2004-05.

In series 2004-05, goods are divided into three major groups viz. primary articles, fuel & power, manufactured products. Primary article group is divided into three subgroups of food

articles, non-food articles and minerals while manufactured products group is divided into 12 subgroups of food products, beverages, tobacco & tobacco products, textiles, wood & wood products, paper & paper products, leather & leather products, rubber & plastic products, chemicals and chemical products, non-metallic mineral products, basic metals alloys & metal products, machinery and machine tools, transport equipment & parts.

4.1. Construction items in commodity basket

As per the study, there are 51 total construction materials identified in series 2004-05 out of which 15 are common between series 2004-05 and series 1993-94. 10 construction items are deleted from series 1993-94 whereas 36 new items are added in the latest series. Total of the weights allotted to these 49 items in the latest series is 8.92431 with the major construction materials/equipment like steel flat-HRC 1.39672, grey cement having 1.26347, 0.73617 for rebars, 0.40622 for rounds (long steel), 0.34117 for bricks & tiles and as low as 0.01417 for lime, 0.0129 for loader, 0.00777 for distemper. Following graph shows the weights allotted to these construction items.

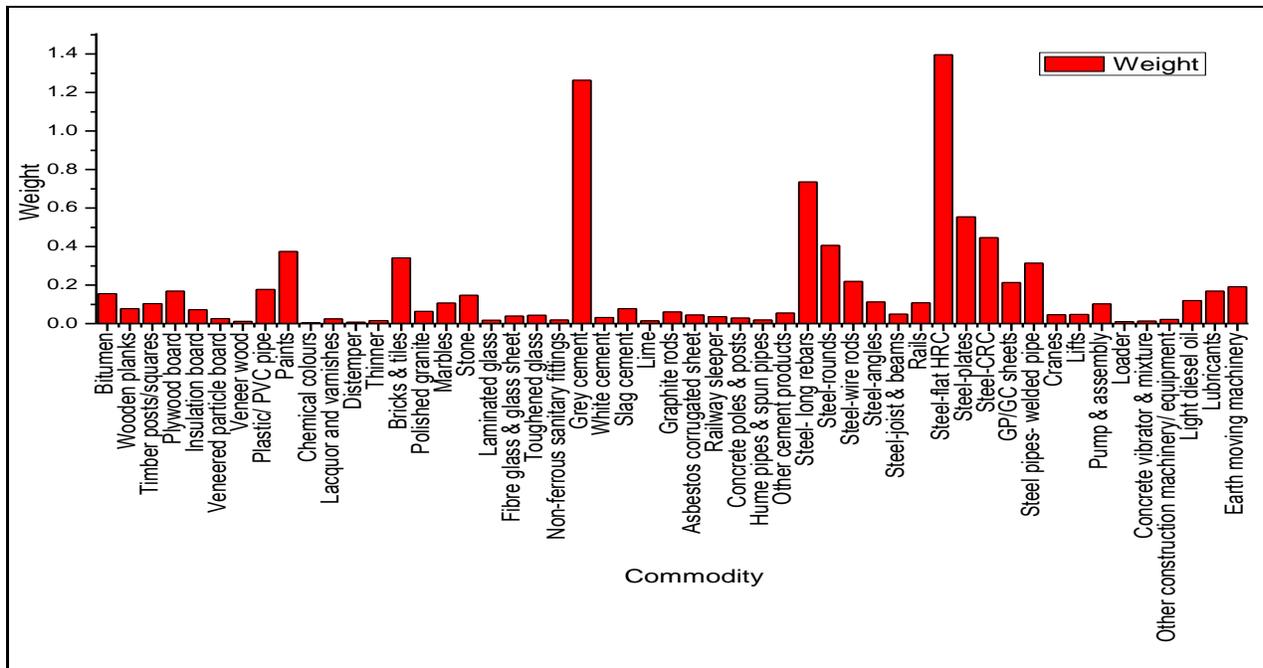


Fig 1. Weight allotment to various construction items identified in WPI commodity basket

5.0. Variation in WPI for major construction materials

Change in WPI over time is the phenomenon of economy. The variation in economic conditions is reflected through changes in WPI. Over the past few years construction industry has witnessed boom. This is also

reflected through significant increase in WPI for major construction materials. The following table highlights this variation in WPI for eight financial years. Fig 2 & 3 indicate the monthly variation in WPI for commodities grey cement and rebars from January to December for the year 2011.

Table 2. Yearly variation in WPI for major construction materials

Commodity	WPI of commodities for month of January							
	2005	2006	2007	2008	2009	2010	2011	2012
Grey cement	100.00	102.20	123.70	137.10	141.60	147.60	147.90	160.70
White cement	100.00	109.90	117.80	140.90	153.30	154.90	159.00	160.80
Bricks & tiles	100.00	106.60	113.40	124.90	136.10	150.40	158.40	180.90
Stone	100.00	115.00	133.30	130.70	136.50	139.20	143.70	162.00
Rebars	100.00	95.80	108.30	128.00	140.40	133.50	144.10	166.00
Bitumen	100.00	121.10	160.00	207.30	225.80	256.10	251.30	324.60

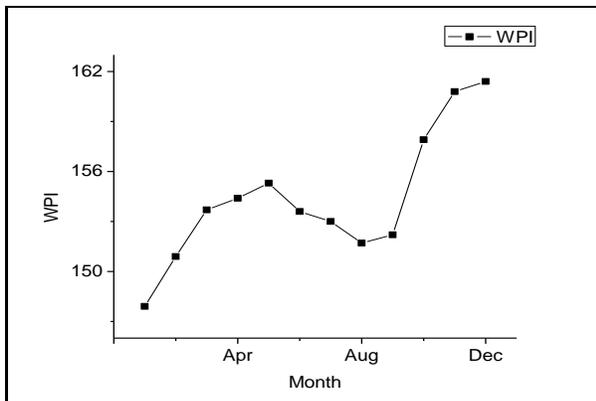


Fig 2. Monthly variations in WPI for grey cement

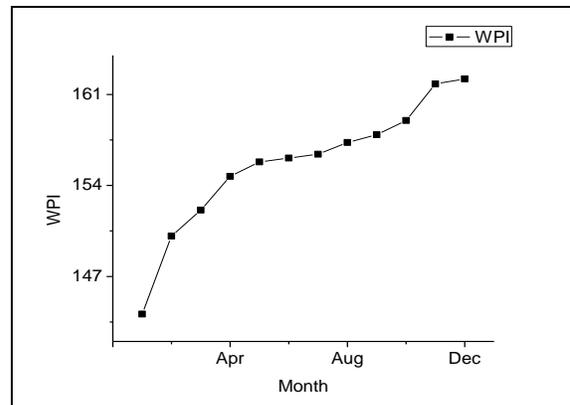


Fig 3. Monthly variations in WPI for rebars

6.0. Escalation calculation by CPWD formulae

CPWD provision for escalation in clause 10CC [4] allows for estimation of escalation amount using different formulae for different components of construction such as labour, material, cement and steel, P.O.L. Standard formula for all these components is as follows:

$$V = W * X * \frac{CI - CI_0}{100 * CI_0}$$

Where,

V = variation in cost of item i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = cost of work done for the period to which escalation is applicable

X = component of item expressed as percentage of total value of work

CI = All India Wholesale Price Index for item for period under consideration as published by Economic Advisor to Government of India, Ministry of Industry and Commerce.

CI₀ = All India Wholesale Price Index for item as valid on the last stipulated date of receipt of tenders including extensions, if any (base index).

Consider, sudden escalation is encountered in Nov'2011 on a construction project in which work of INR 2,00,000 is executed in this period and quantity of grey cement accounts for 40% of the work and the base i.e. CIO is taken as Jan'2011 for grey cement. Then the escalation amount to be recovered from the owner comes out to be INR 6977.68. If the same is encountered in the month of Dec'2011, the amount comes as INR 7302.23.

Hence, any variation in WPI from date of receipt of tender to the date of actual computation is directly proportional to the variation in cost of item to be recovered under escalation.

6.1. Case study

Escalation is one of the most dispute prone clauses in construction contracts as per the study of Iyer and Kalidindi (2002). Various claims related to escalation were studied. One of the claims was raised on a project of lining of left bank canal which followed CPWD conditions of contract. Claim was for balance payment of price escalation amount. For working out the amount of compensation, the base index to be adopted was the average index for the quarter preceding the date of opening the tender as specified in contract document. Hence there was ambiguity in considering the value of CIO as shown in the formula above.

The owner had adopted different meaning of quarter and had taken indices of three months prior to date of opening i.e. of month June. No definition of term quarter was provided in GCC, hence definition in common parlance should have been adopted i.e. 1/4 th of a year. As the bids were opened on 27/9/1994, quarter preceding it would have been April-May-June. Hence, the contractor claimed for the difference of INR 5,00,681. Taking WPI for calculations as the average of WPIs for the months April-May-June instead of June as was calculated by the respondent, the difference of amount payable to the contractor came out to be INR 5,00,681. The contractor's case was found to be genuine and hence this amount was granted to the contractor.

This shows that WPI varies in a very short time span and affects the amount computed using escalation formula.

7.0. Findings and suggestions

7.1. Findings

1. From the total of weights allotted to the identified construction items, it is seen that as per series 2004-05, construction items account for approximately 9% of the total economy. Series 1993-94 allots 5.5% of the weights to construction items. Hence there is drastic rise of 3.5% in the weightage of construction items from old to revised series.
2. Among the various materials and machinery considered in the commodity basket of series 2004-05, it is observed that flat HRC steel has the highest weight followed by grey cement and steel rebars. Major items affecting the price of work are identified as cement and steel which consume higher weights and affect the overall cost of the work executed. Items such as bricks & tiles, paints, various types of steel items also consume considerable weights.
3. In series 1993-94, commodities such as building bricks, ceramic tiles, fire bricks were considered as separate entities. But as the individual weights assigned were very low these commodities are now grouped in series 2004-05 forming one commodity of bricks & tiles. Cement was a separate entity in series 1993-94 with 1.73105 weight whereas this entity is divided into four separate commodities of grey cement, white cement, slag cement, lime under the heading cement & lime in series 2004-05.
4. Under the subgroup of machinery & machine tools, separate provision for construction machinery has been made which takes into account major construction machinery such as loader, concrete vibrator & mixture and other construction machinery / equipment. Commodity other construction machinery / equipment is supposed to take into account all the rest machinery which are not separately given weightage in the series. Earth moving machinery though majorly implemented on construction works is included under the heading non-electrical machinery rather than construction machinery. There was removal of commodity excavator from machinery in series 1993-94 which was given weightage of 0.10637.
5. Items such as tractor, trucks, diesel, lubricants, safety helmets, hydraulic & pneumatic tools, compressors etc are given weightage in WPI series based on their overall transactions in the market. These items consume a considerable portion of budget on construction sites. Considering their overall weight for calculation of escalation is ridiculous as only percentage of these items would have been consumed by

construction sector and only this percentage should affect the computation of escalation.

6. Variation in WPI exhibits a typical trend of increase over years. For some materials this variation is either gradual or drastic. Variation on the negative side may also be encountered with some materials whose market rate falls in course of time. This is indicative from value of WPI for stone for the year 2007 & 2008 and that for rebars for the year 2009 & 2010. There was negative change observed in WPI for bitumen in the year 2011 whereas it experienced a drastic increase in WPI in the month of January'2012.
7. These ups and downs in the values of WPI of the construction materials directly affect the amount of escalation derived from the formulae for different components of construction given in clause 10 CC of CPWD conditions of contract. The most important cause for the gap between actual escalation occurred and escalation payment made based on the currently used escalation clause in the CPWD contract is mainly due to the application of the WPI in the escalation formula for calculating the escalation payment.

7.2. Suggestions

1. Products such as rubber transmission belt, V belt, plastic cabinet, pencil, dried tobacco, cotton pillow cover etc. which consume very less weightage approximately of the order of 10^{-2} , are included in the commodity basket. It is important to include sand, being one of the most important commodities utilised on construction sites, as one of the commodity in the series.
2. All the construction related items should be grouped under one sub-group for ease of calculations as it is provided for rubber and textile industry. For items such as tractor, trucks, diesel, lubricants etc. which are given weightage in WPI series based on their overall transactions in the market, a percentage figure should be provided which would represent the share of construction sector in the total weightage of the commodity.
3. Efforts should be made to source the data of commodities and their quotations from different parts of the country in order to have a variety of data. This would maintain geographically balanced character of the wholesale price index thus making it more appropriate.
4. WPI varies in a very short span of time and hence the amount calculated using the formulae is time sensitive. Base month to be considered in the computation of WPI for any particular material should be fixed and accepted by both the

contracting parties. The month or quarter in which escalation in prices was observed should be clearly identified and accepted.

5. As seen from the statistics, construction items in the latest series account for approximately 9%. Considering unwanted 91% of items which have got no relation with the items under consideration affects the escalation amount payable. Hence using WPI is irrelevant in calculating escalation amount for construction materials.
6. As WPI is calculated based on the prices at wholesale level, it does not depict the exact market situation, hence switching to a better index such as PPI or CPI would be beneficial as price changes from producers' and consumers' perspective are more relevant and technically superior compared to one at wholesale level. This should be taken into account by CPWD in revising the contract conditions.
7. A separate index for construction items such as building cost index (BCI) should be drafted and adopted. Use of BCI for escalation calculation would be more appropriate as it would consider the effect of construction related items only. Being a specialised index, many construction related items which are not included in WPI series due to their very less or negligible weightage can be accommodated in the series of BCI.
8. Considering the emerging new technologies in construction industry, new materials such as aluminium formwork, ferrocement, roofing textile fabrics, paving blocks etc., need to be given due consideration in revising the series. Revision of series should be exercised yearly so as to consider the effect of new technologies, new materials coming in the market.

8.0. Conclusion

The WPI which is considered for calculation of escalation for civil engineering items comprises of basket of materials which contain approximately 91% of materials those are not directly related to construction field. The compensation paid to the contractor based on the currently used escalation clause in CPWD contracts is not adequate as it considers WPI for its computation. Hence it is quite evident that the escalation calculated using WPI may not reflect the correct increase and may be unjust to either owner or contractor. Hence there is a dire need to develop an index which is exclusively useful to the construction sector which is second largest industry in India. This study highlights the need of such index.

References

- [1] URL1:http://eaindustry.nic.in/WPI_Manual.pdf, Date visited-15/02/2012
- [2] URL 2:<http://www.investopedia.com/terms>, Date visited- 27/04/12
- [3] URL3:<http://www.eaindustry.nic.in>, Date visited-4/01/12
- [4] Government of India. (2008) General Conditions of Contract for Central Public Works Department Works. DG(W), CPWD,Nirman Bhawan, New Delhi, India, 110011.
- [5] Chau K.W. (2006), 'Prediction of construction litigation outcome-A case based reasoning approach'. M. Ali and R.Dapoigny(Eds) IEA/ AIE Springer- verlag Berlin Heidelberg, pp. 548-553.
- [6] Choi M., Jinu Kim, Moohan Kim (2006), 'A study on the price escalation system in a construction contract'. KSCE Journal of civil engineering, Vol. 10, No.4, pp. 227-232.
- [7] Iyer K.C., Kalidindi S.N. (2002), 'Final and binding power clauses in Indian construction contracts'. International Journal of project management, Vol. 20, pp. 13-22.
- [8] John K. Hollmann, Larry R. Dysert (2007), 'Escalation estimation: working with economics consultants'. AACE International transactions.
- [9] Kartam S. (1999), 'Generic methodology for analyzing delay claims', J. Construction Engineering and Management, ASCE, Vol. 125, No. 6, December, pp. 409-419.
- [10] Touran Ali, Ramon Lopez (2006), ' Modeling cost escalation in large infrastructure projects', Journal of construction engineering and management, ASCE, Vol. 132, No. 8, pp. 853-860.
- [11] Williams T. (1994), 'Predicting changes in construction cost indexes using neural networks', Journal of construction engineering and management, ASCE, Vol. 120, No. 2, pp. 306-320.
- [12] Maran R., Rajendran S., Kalidindi S. (2011), ' Material cost & escalation clauses in Indian construction contracts', Proceedings of ICE-construction materials, Vol. 164, Issue 2, pp 95-108.

