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Background

The Royal Audit Authority (RAA) carried out “Review on Bhutan Schedules of Rates and its applications by the Government Agencies” as mandated by the Constitution of the Kingdom of Bhutan and Audit Act of Bhutan 2006.

The study involved ascertaining the adequacy and relevancy of existing Bhutan Schedules of Rates and enforcement mechanisms and practices in application of prevailing BSR in public procurement of works.

Cost Index: To derive the approximate item rate at any location, the BSR item rates of the nearest base town shall be enhanced by the cost index calculated.

Procedure adopted for calculation of cost index is:

- a) Basic rates at nearest base town
- b) Rates at the project location
- c) $[\{\text{Rates at Project location/Basic rates at nearest base town}\} \text{ minus } 1] \times 100$
- d) Weightage shall remain fixed (weightage of a particular material is the percentage of its cost from the total cost of the Project)
- e) $\{[\{\text{Rates at Project location/Basic rates at nearest base town}\} \text{ minus } 1] \times 100 \times \text{Weightage}\} / 100$ shall remain fixed (weightage of a particular material is the percentage of its cost from the total cost of the Project)

The Cost index shall not be applicable for:

- All base rates
- Any works where only labour is involved such as:-
 - Dismantling and demolition
 - Earthworks
 - Installation, testing, commissioning

Purpose of Analysis of rates are:

- a) To work out the actual cost of per unit of the items.
- b) To work out the economical use of materials and processes in completing the particulars item.
- c) To work out the cost of extra items which are not provided in the contract bond, but are to be done as per the directions of the department.
- d) To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.

Definition of Rate Analysis:

Rate analysis of Civil Works is the determination of cost of each construction work per unit quantity. This cost includes the cost of materials, labours, machinery, contractors profit and other miscellaneous petty expenses required for the particular work to be complete in unit quantity. The cost of materials in rate analysis is calculated as combination of cost of material at origin, its

transportation costs, and taxes. The rate of labour is based on skill of the labour, such as skilled labour, semi-skilled and unskilled labour. The cost of materials and labours vary from place to place. Thus, the cost of each construction work varies from place to place.

Audit Objectives

The overall objective of the review is to ascertain whether the existing Bhutan Schedules of Rates is being uniformly and consistently applied across all government agencies and achieving value for money in implementation of Government and Donor Funded infrastructure Projects.

The specific objectives are:

- a) To review adequacy of Bhutan Schedules of Rates in the Procurement of works viz. preparation of estimates and payment on variations works;
- b) To identify flaws and ambiguities in the application of Bhutan Schedules of Rates in the procurements for works;
- c) Existence of proper guidelines and templates on the computation of cost index and carrying out rate analysis.
- d) Existence of appropriate level of authority approving the applicability of cost index and analyzed rates; and
- e) To recommend measures to improve the existing Bhutan Schedules of Rates embracing the principles and good practices for effective applications and computation of cost index and analysis of rates achieving value for money in procurements of works.

Audit Scope

The review was carried out for works executed during the period 2016-17 and 2017-2018. For the purpose of this review, few procuring agencies were selected across the country.

Audit Methodology

The RAA used following audit methodologies:

Documentary Review

- a) Examine and review BSR, Estimates, Variation Orders, working papers on the computation of cost index and analysis of rates including guidelines if any stipulated in the BSR for the computation of cost index and Rate analysis.
- b) Review of documents relating to market survey carried out by the agencies in obtaining market rates for computation of cost index and analyzing of rates.

Findings: Deficiencies & Lapses

The present study on the application of Bhutan Schedules of Rates (BSR) for the preparation of cost estimates for infrastructures projects and pricing of the variations in a works contract prevailing in different government agencies draws out clearly a very important point that BSR is one of the major factor in determining and achieving value for money in the execution of government infrastructure projects. The BSR plays a very pivotal benchmark in the preparation of realistic estimated cost and economical valuation of varied items of works of the project. The BSR however outlines the followings:

- a) The rates in the BSR are based on market prices of materials collected from the hardware retail shops in the four base town Gelephu, Phuentsholing, Samdrup Jongkhar and Thimphu and other relevant Government and private agencies within Bhutan.
- b) The BSR reflect only the average price since there are various brands of materials available in the market for each item.
- c) The prices collected are of those materials approved by the Bhutan Standard Bureau (BSB).
- d) The users are urged to use the BSR as a guide only and for any specific projects, engineers will have to collect market prices and analyzed the rates using the labour and material coefficients (LMC) published along with the BSR.
- e) Calculation of cost indices had been detailed and few samples are provided on calculation of cost at the back of BSR to arrive at the actual cost of a particular project at a location other than the base towns.
- f) The rates shown for all built-up-items are for up to 10 Km radius and inclusive of 5% hand tools & equipment and machinery & martial wastages, 1% water charges and 10% overhead charges.
- g) BSR contains only commonly used items, the new items may be worked out and analyzed by the engineers as may be relevant.
- h) The procuring agencies are suggested to analyze rates for specific construction projects as the BSR is designed primarily as a tool for estimation of construction projects.

Further, while the BSR appropriately outlined the procedures for calculation of rates at the project locations, the study indicated existence of varying practices being adopted in the computation of cost index and rate analysis by various agencies impacting adverse financial burden to the government through overestimations of project cost and analyzing exorbitant cost per unit for valuation of varied items of works.

The RAA also had observed shortcomings and lapses of pertinent nature involving poor assessment of item rates at the project locations in the absence of standard data management and data dissemination. The current practices in the calculation and application of cost index is plagued with numerous systemic problems, unclear strategies and objectives with consequential adverse impact on the cost of project thereby impeding achievement of value-for-money in the overall programme implementation. The Royal Audit Authority has been continually reporting the systemic lapses to the Royal Government of Bhutan through various specific reports and Annual Audit Reports along with its recommendations. However, the shortcomings in this sector

continue to surface in the system indicating that it has not received appropriate interventions from the policy makers and other stakeholders.

Therefore, the RAA reiterates the subject with exclusive focus on the cost index and rate analysis as discussed below drawing attentions of the policy makers and other stakeholders for policy interventions directed towards achieving value for money through efficient and effective computation and application of cost index and rate analysis including due diligence in obtaining the prevailing market rates for materials or item rates at the project locations.

1.1 Issues relating to Cost Index

The Price and cost indices are a basic tool for anyone involved in estimating, cost checking and fee negotiation on public sector construction works, including roads.

The issues observed in computation and application of Cost Index are identified under different areas of applications. Some of the common issues observed by the RAA are discussed below:

1.1.1 Inconsistent formulation of cost index

- a) Bhutan Schedule of Rates (BSR) is the basis for the preparation of the project costs. To arrive at the actual cost for a particular project at a location other than the base towns, cost indices are calculated and applied to derive the approximate item rate at any location.
- b) The RAA carried out an exercise to confirm whether the government agencies are adopting consistent approaches and procedures laid down in the BSR in the calculation and application of cost index in deriving the approximate item rates at any location based on the BSR item rates of the nearest base town.
- c) The RAA found that the Government agencies while compliance to the laid down procedures for calculation of rates at the project locations are adhered to, varying formulation of cost indices are tabulated below:

Table 1: Varying formulation of cost index

2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	Dzongkhag
Over BSR 2013: 20%	Over BSR 2013 : 20%	Over BSR 2013 : 20%	BSR 2017		Punakha
	Over BSR 2013: 22%	BSR 2015	BSR 2015	BSR 2017	Paro
		Over BSR 2015: 5%	Over BSR 2015: 5%	BSR 2017	Thimphu
		Civil-Works: 35.10% Electrical Works : 12.95%	Civil-Works : 35.10% Electrical Works: 12.95%	Civil-Works : 30.67% Electrical Works:11.79%	HAA
Khatoed: 34.20% Khamoed: 25.36% Laya: 71.34% Lunana:100.55%	Khatoed: 34.20% Khamoed:25.36% Laya:71.34% Lunana: 100.55%	Khatoed: 34.20% Khamoed:25.36% Laya: 71.34% Lunana: 100.55%			Gasa
				Cost Index over BSR 2017 Civil works: 13.01%	Chukha
		Others as per BSR 2013 Electrical: 4.20 % on BSR 2013	Based on BSR 2015	On BSR 2017: Civil: 8.38% Electrical: 2.51% Road Base Course: 5.8%	Sarpang

				Road Bitumen Sealing: 9.03%	
Over BSR 2013 : 21.9%		Over BSR 2015 : 26.87%		Over BSR 2017 : 28.54%	Dagana
Over BSR 2012 Roads: 17.43% Building works: 20.50%		Over BSR 2015 Building works: 20.50%	Over BSR 2017 Roads: 22.28% Building works: 9.94% Electrical:21.65%		Zhemgang
Over BSR 2012 -Brick masonry & timber truss- 16% till Damphu -Stone Masonry & timber truss- 18% till Damphu -For Gewogs add transportation	Over BSR 2013 -Brick masonry & steel truss- 22.50% till Damphu -Brick masonry & timber truss- 13.16% till Damphu -Road works Bitumen sealing- 18.50 % till Damphu -Road works- Permanent works -38% till Damphu -Road works Base course- 42% -For Gewogs add transportation cost		Over BSR 2015 -Brick masonry & steel truss- 12.46% till Damphu -Brick masonry & timber truss- 23 % till Damphu -Stone Masonry & timber truss- 14.08% till Damphu -Road works Bitumen sealing- 13.30 % till Damphu -Road works- Permanent works - 30.29% till Damphu -Road works Base course- 24.92% till Damphu -For Geogs add transportation cost		Tsirang
	Cost Index over BSR 2012 Civil works: 22.04% Site Development works: 15.37% Electrical works: 10.59%	Cost Index over BSR 2012 Civil works: 26.57% Site Development works: 18.62% Electrical works: 8.32%	Cost Index over BSR 2015 Civil works: 21.17% Site Development works: 17.92% Electrical works: 9.12%	Cost Index over BSR 2017 Civil works: 15.45% Site Development works: 1.61% Electrical works: 13.16%	Mongar
BSR 2013: 19.80%	BSR 2013: 19.80%	BSR 2015: 24.27%	BSR 2015: 24.27%	BSR 2017: 25.28%	Pemagatshel
Cost Index over BSR 2013 Civil works : 34.22% Electrical works: 3.61%	Cost Index over BSR 2013 Civil works : 34.22% Electrical works :3.61%	Cost Index over BSR 2015 Civil works : 34.22% Electrical works : 3.61%	Cost Index over BSR 2015 Civil works : 34.22% Electrical works : 3.61%	Cost Index over BSR 2017 Civil works : 34.22% Electrical works : 3.61%	Lhuentse
			Cost Index over BSR 2015 Building works: 22.84% Bitumen Sealing: 23.79% Road works: 21.82% Base Course works: 20.35%	Cost Index over BSR 2017 Building works: 19.84% Bitumen Sealing: 20.79% Road works: 10.38% Base Course works: 14.88%	Trashigang
	BSR 2013 Civil work-5% Civil work-10%	BSR 2015	BSR2015		Samtse
Cost Index over BSR 2013	Cost Index over BSR 2015	Cost Index over BSR 2015	Cost Index over BSR 2015		Trashiyangtse

Civil Works: 26.22% Electrical works: 8.7%	Civil Works: 26.22% Electrical works: 8.7%	Civil Works: 26.22% Electrical works: 8.7%	Civil Works: 21.52% Electrical works: 17.58%		
			BSR 2015 -Widening works- 28.08% -Gabion Wall- 15.10% -Resurfacing Works- 8.96% -Retaining Wall- 30.31% -Vented Cause Way- 31.36%		Trongsa
	Over BSR 2013 Civil work- 15.39%	Over BSR 2013 Civil work-15.39% Base course-15.39%	Over BSR 2015 Civil work- 7.01%		Wangdi
Cost Index over BSR 2012 Civil Works: 20.98% Electrical works: 24.38%	Cost Index over BSR 2012 Civil Works: 20.98% Electrical works: 24.38%	Cost Index over BSR 2015 Civil Works: 33.49% Electrical works: Tang: 26.09% Ura: 24.40% Chokhor: 23.81% Chumey: 22.27%	Cost Index over BSR 2015 Civil Works: 33.49% Electrical works: Tang: 26.09% Ura: 24.40% Chokhor: 23.81% Chumey: 22.27%	Cost Index over BSR 2017 Building works with brick infill: 56.40% Building works with stone infill: 37.44% Bitumen Sealing: 21.97% Base Course works:70.80% Electrical works: 23.38%	Bumthang
Over BSR 2012 Jomotsangkha Dungkhag: Electrical : 9.86% Stone Masonry works: 12.03% Brick works: 5.53% Road works : 32.60% Samdrucholing Dungkhag: Electrical: 9.55% Serthi Gewog: Electrical 9.97% Pemathang Gewog: Electrical: 9.60% Martshala Gewog: Electrical: 9.68% Orong Gewog: Electrical: 9.52% Stone Masonry works: 13.48% Brick works: 14.09% Road works : 20.73%	Over BSR 2012 Jomotsangkha Dungkhag: Electrical : 9.86% Stone Masonry works: 12.03% Brick works: 5.53% Road works : 32.60% Samdrucholing Dungkhag: Electrical: 9.55% Serthi Gewog: Electrical 9.97% Pemathang Gewog: Electrical: 9.60% Martshala Gewog: Electrical: 9.68% Orong Gewog: Electrical: 9.52% Stone Masonry works: 13.48% Brick works: 14.09% Road works : 20.73% Gomdar Gewog: Electrical: 9.55%	Electrical over BSR 2012 Jomotsangkha Dungkhag: Electrical : 9.86% Stone Masonry works: 12.03% Brick works: 5.53% Road works : 32.60% Samdrucholing Dungkhag: Electrical: 9.55% Serthi Gewog: Electrical 9.97% Pemathang Gewog: Electrical: 9.60% Martshala Gewog: Electrical: 9.68% Orong Gewog: Electrical: 9.52% Stone Masonry works: 13.48% Brick works: 14.09% Road works : 20.73% Gomdar Gewog: Electrical: 9.55% Stone Masonry works: 12.80% Brick works: 15.93% Road works : 16.94% Dewathang Gewog:	Electrical over BSR 2012 Jomotsangkha Dungkhag: Electrical : 9.86% Stone Masonry works: 12.03% Brick works: 5.53% Road works : 32.60% Samdrucholing Dungkhag: Electrical: 9.55% Serthi Gewog: Electrical 9.97% Pemathang Gewog: Electrical: 9.60% Martshala Gewog: Electrical: 9.68% Orong Gewog: Electrical: 9.52% Stone Masonry works: 13.48% Brick works: 14.09% Road works : 20.73% Gomdar Gewog: Electrical: 9.55% Stone Masonry works: 12.80%	Electrical over BSR 2012	S/Jongkhar

<p>Gomdar Gewog: Electrical: 9.55% Stone Masonry works: 12.80% Brick works: 15.93% Road works : 16.94% Dewathang Gewog: Electrical: 9.25% Stone Masonry works: 7.39% Brick works: 13.49% Road works : 13.99% Wangphu Gewog Stone Masonry works: 17.15% Brick works: 14.96% Road works : 32.79%</p>	<p>Stone Masonry works: 12.80% Brick works: 15.93% Road works : 16.94% Dewathang Gewog: Electrical: 9.25% Stone Masonry works: 7.39% Brick works: 13.49% Road works : 13.99% Wangphu Gewog Stone Masonry works: 17.15% Brick works: 14.96% Road works : 32.79%</p>	<p>Electrical: 9.25% Stone Masonry works: 7.39% Brick works: 13.49% Road works : 13.99% Wangphu Gewog Stone Masonry works: 17.15% Brick works: 14.96% Road works : 32.79%</p>	<p>Brick works: 15.93% Road works : 16.94% Dewathang Gewog: Electrical: 9.25% Stone Masonry works: 7.39% Brick works: 13.49% Road works : 13.99% Wangphu Gewog Stone Masonry works: 17.15% Brick works: 14.96% Road works : 32.79%</p>		
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- d) The absence of check and control by appropriate or designated authority had allowed the government agencies to resort to varying decisions in the formulation of cost indices as highlighted in the **table 1**.
- e) Thus such varying formulation of cost indices indicated that the officials responsible for calculation and application of cost indices are either lacked clarity in the procedures provided in the BSR or not competent enough to appropriately interpret the laid down procedures in the BSR.

1.1.2 Application of cost index not aligned with items of works

- a) The BSR requires the agencies to determine the cost index based on the procedures provided for the calculation of cost indices to arrive at the actual cost of a particular project at all location other than the base towns.
- b) The RAA observed that the calculation and application of cost indices are not aligned with the components specified in the labour and material coefficients (LMC) as well as Sample cost indices table provided in the BSR against specific items of works of the BSR.
- c) The LMC and tables provided for calculation of cost indices in the BSR against each specific item of work are as given in the tables below:

Table A: Building works with brick infill walls and steel trusses

Description	Weight use
Cement	17.00
steel reinforcement	14.00
CGI sheet	5.00
Brick/ICEB	10.50
Stone boulder	1.50
Rough swan timber	19.00
Stone aggregates(20mm)	4.50
sand	2.00
labour average:	
Category I to IV	11.50
Category V	15.00
Total	100

Table C: Building works with stone masonry infill wall

Description	Weight use
Cement	17.00
steel reinforcement	5.00
CGI sheet	8.00
Brick/ICEB	1.00
Stone boulder	6.00
Rough swan timber	22.00
Stone aggregates (20mm)	3.00
sand	2.00
labour average:	
Category I to IV	20.00
Category V	15.00
Total	100

Table E: Road Permanent works: Retaining walls, Culvert and other similar works

Description	Weight use
Cement	30.00
Stone boulder	20.00
Stone aggregates(20mm)	3.00
Sand	5.00
labour average:	
Category I to IV	16.00
Category V	26.00
Total	100

Table B: Building works with brick infill walls and timber trusses

Description	Weight use
Cement	17.00
steel reinforcement	14.00
rolled steel	3.00
CGI sheet	5.00
Brick/ICEB	9.50
Stone boulder	1.50
Rough swan timber	17.00
Stone aggregates (20mm)	4.50
sand	2.00
labour average:	
Category I to IV	11.50
Category V	15.00
Total	100

Table D: Bitumen sealing works

Description	Weight use
Bitumen	63.00
Road Roller (8-10T)	9.00
Fire wood	3.00
Stone aggregates (20mm)	14.00
labour average:	
Category I to IV	0.50
Category V	10.50
Total	100

Table F: Road works: Base Course

Description	Weight use
stone boulder	5.00
Road Roller (8-10T)	32.00
Binding materials	3.75
Stone aggregates(20mm)	42.00
labour average:	
Category I to IV	0.25
Category V	17.00
Total	100

The review noted that varying procedures and applications of cost indices are adopted by various government agencies as discussed below:

- Six Dzongkhags had used a flat cost indices without working out the cost indices for various types of building and road works
- Four Dzongkhags had used a flat cost indices for all types of civil works and a different cost indices for electrical works
- Three Dzongkhags had calculated and used difference cost indices for various item of works of road works

- d) Two Dzongkhags had used average cost indices for all types of building and road roads
- e) Four Dzongkhags had used difference cost indices for different types of building and roads works:

Table detailing application of varying cost indices by Dzongkhags

Name of Dzongkhag	One cost index for All type Building works	One cost index for all Bitumen Sealing works	One cost index for all road permanent works	One cost index for all Base Course works	Use of average cost indices for civil works and road works	Use of flat cost indices for all works	Use of different cost indices for brick and stone masonry works	Use of different cost indices for different types of building & road works
Punakha						✓		
Paro						✓		
Thimphu						✓		
Chukha						✓	✓	✓
Sarpang	✓	✓		✓				
Dagana						✓		
Zhemgang	✓		✓					
Tsirang								✓
Mongar	✓							
P/gatshel					✓			
S/Jongkhar			✓				✓	✓
Lhuentse						✓	✓	✓
T/yangtse					✓			
Trashigang	✓	✓	✓	✓				
Trongsa								✓
Samtse	✓							
Wangdi	✓			✓				
Bumthang								✓

The Regional Office has calculated and applied cost indices on each component of items of works as detailed below:

Name of works	Cost index percentage
Resurfacing Works	8.96%
Construction of Retaining Wall	30.31%
Widening works incl. blind curves	28.08%
Construction of Gabion Wall	15.06%
Construction of Vented Cause Way	31.36%

The tables above indicated that cost indices were not aligned to the specific types of civil and road works as defined in the samples incorporated in the BSR. This would have consequential effect on the cost of the civil and road works.

The development of cost indices in terms of specific types and item of works would render basis for estimating realistic project cost.

The lapses in these areas might have following consequences:

- Undermining and compromising the realistic preparation of project cost as there is no validation of technical soundness of the cost indices prepared and applied by various government agencies; and
- Avoidable cost as estimated project cost are made available with the tender documents and land up awarding contracts at uneconomical or inflated quoted prices. If the decisions are not driven by objective basis, it would have been taken solely to benefit the parties by way of inflated estimated project cost.

1.1.3 Calculation of cost index not aligned to distance from the base town

The BSR requires the agencies to determine the cost index based on the procedures provided for the calculation of cost indices to arrive at the actual cost of a particular project at any location other than the base towns. Thus to derive the approximate item rate at any location, the BSR item rates of the nearest base town is to be enhanced by the cost index calculated.

In consideration to the defined cost index calculation procedures, cost indices are to be regulated in terms of distance of project location from the nearest base town.

The review of cost indices worked out and applied for various project works by Government agencies noted that cost indices are not aligned in terms of distances as detailed in the table below:

Table detailing application of varying cost indices:

Name of Dzongkhag	Nearest Base Town	Distance in KM	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Punakha	Thimphu	71(T)	BSR 2013 : 20%	BSR 2013: 20%	BSR 2015: 20%	BSR 2017	
Paro	Thimphu	54(T)	BSR 2013: 22%	BSR 2015	BSR 2015	BSR 2017	
Thimphu	Thimphu	0		BSR 2015: 5%	BSR 2015: 5%	BSR 2017	
HAA	Thimphu	112(T)			Civil-Works : 35.10%	Civil-Works : 35.10%	Civil-Works : 30.67%
Gasa	Thimphu	98(T)	Khatoed: 34.20% , Khamoed: 25.36%, Laya: 71.34% Lunana: 100.55%	Khatoed: 34.20% , Khamoed: 25.36%, Laya: 71.34% Lunana: 100.55%	Khatoed: 34.20% , Khamoed: 25.36%, Laya : 71.34% Lunana: 100.55%		
Trongsa	Thimphu	199(T)				BSR 2015 Widening works- 28.08% Gabion Wall- 15.10% Resurfacing Works-8.96% Retaining Wall-30.31% Vented Cause Way-31.36%	
Wangdi	Thimphu	70(T)		BSR 2013 Civil work- 15.39%	BSR 2013 Civil work- 15.39% Base course- 15.39%	BSR 2015 Civil work- 7.01%	
Bumthang	Thimphu	267(T)	BSR 2012 Civil Works: 20.98%	BSR 2012 Civil Works: 20.98%	BSR 2015 Civil Works: 33.49%	BSR 2015 Civil Works: 33.49%	BSR 2017 Building works-bricks:56.40 % Building works-stone masonry: 37.44%

							Bitumen Sealing: 21.97% , Base Course works: 70.80%
Chukha	P'ling	82(P)					BSR 2017: Civil works : 13.01%
Samtse	P'ling	74 (P)		BSR 2013 Civil works-10% (new) Civil works – Maintenance -5%	BSR 2015	BSR2015	
Sarpang	Gelephu	33(G)			BSR 2013	BSR 2015	On BSR 2017: .., Civil works : -8.38%, bitumen sealing :9.03% Base course:5.8%
Dagana	Gelephu / Thimphu	198(G)	BSR 2013: Brick and steel trusses works: 16.16%, brick and timber works: 16.89%, Stone masonry works: 21.45% Permanent road works: 24.27%, Base Course= 39.45% , Bitumen sealing works:12.89%	BSR 2013: Brick and steel trusses works: 16.16%, brick and timber works: 16.89%, Stone masonry works: 21.45% Permanent road works: 24.27%, Base Course= 39.45% , Bitumen sealing works:12.89%	BSR 2015: Brick and steel trusses works: 24.85%, brick and timber works: 24.59%, Stone masonry works: 31.18% Bitumen sealing works: 40.29%, Permanent road works:49%, Base Course= 38.21% %	BSR 2015: Brick and steel trusses works: 24.85%, brick and timber works: 24.59%, Stone masonry works: 31.18% Bitumen sealing works: 40.29%, Permanent road works:49%, Base Course=38.21 %	BSR 2017: Brick and steel trusses works:29.49 % , brick and timber works: 29.70%, Stone masonry works:26.43 %
Zhemgang	Gelephu	133(G)	BSR 2012: Road: 17.43%, Building 20.50%		BSR 2015 Building: 20.50%	BSR 2017 Road:22.28% Building: 9.95%	
Tsirang	Gelephu	93(G)	BSR 2012: brick and timber trusses: 16 % , Stone masonry	BSR 2013: Brick and steel trusses works: 22.50%, brick and		BSR 2015: Brick and steel trusses works: 12.46%, brick and	

			and timber trusses: 18%	timber trusses: 13.16%, Stone masonry works and timber trusses: 26% Permanent road works: 38%, Base Course: 42%, Bitumen sealing works: 18.50%		timber trusses: 23%, Stone masonry works and timber trusses: 14.08% Permanent road works: 30.29%, Base Course= 24.92%, Bitumen sealing works: 13.30%	
Mongar	S/Jongkhar	271 (S/J)	BSR 2012 Civil works: 22.04% Site Development works: 15.37%	BSR 2012 Civil works: 26.57% Site Development works: 18.62%	BSR 2015 Civil works: 21.17% Site Development works: 17.92%	BSR 2017 Civil works: 15.45% Site Development works: 15.37%	
Pemagatshel	S/Jongkhar	100 (S/J)	BSR 2013: 19.80%	BSR 2013: 19.80%	BSR 2015: 24.27%	BSR 2015: 24.27%	BSR 2017: 25.28%
S/Jongkhar	S/Jongkhar	0	BSR 2012 Jomotsangkha Dungkhag Stone Masonry works: 12.03%, Brick works: 5.53%, Road works : 32.60% Dewathang Gewog Stone Masonry works: 7.39%, Brick works: 13.49%, Road works : 13.99% Orong Gewog: Stone Masonry works: 13.48%,	BSR 2012 Jomotsangkha Dungkhag Stone Masonry works: 12.03%, Brick works: 5.53%, Road works : 32.60% Dewathang Gewog Stone Masonry works: 7.39%, Brick works: 13.49%, Road works : 13.99% Orong Gewog: Stone Masonry works: 13.48%,	BSR 2012 Jomotsangkha Dungkhag Stone Masonry works: 12.03%, Brick works: 5.53%, Road works : 32.60% Dewathang Gewog Stone Masonry works: 7.39%, Brick works: 13.49%, Road works : 13.99% Orong Gewog: Stone Masonry works: 13.48%, Brick works: 14.09%,	BSR 2012 Jomotsangkha Dungkhag Stone Masonry works: 12.03%, Brick works: 5.53%, Road works : 32.60% Dewathang Gewog Stone Masonry works: 7.39%, Brick works: 13.49%, Road works : 13.99% Orong Gewog: Stone Masonry works: 13.48%, Brick works: 14.09%,	

			Brick works: 14.09%, Road works : 20.73% Gomdar Gewog Stone Masonry works: 12.80%, Brick works: 15.93%, Road works : 16.94% Wangphu Gewog Stone Masonry works: 17.15%, Brick works: 14.96%, Road works : 32.79%	Brick works: 14.09%, Road works : 20.73% Gomdar Gewog Stone Masonry works: 12.80%, Brick works: 15.93%, Road works : 16.94% Wangphu Gewog Stone Masonry works: 17.15%, Brick works: 14.96%, Road works : 32.79%	Road works : 20.73% Gomdar Gewog Stone Masonry works: 12.80%, Brick works: 15.93%, Road works : 16.94% Wangphu Gewog Stone Masonry works: 17.15%, Brick works: 14.96%, Road works : 32.79%	Road works : 20.73% Gomdar Gewog Stone Masonry works: 12.80%, Brick works: 15.93%, Road works : 16.94% Wangphu Gewog Stone Masonry works: 17.15%, Brick works: 14.96%, Road works : 32.79%	
Lhuentse	S/Jongkhar	346 (S/J)	BSR 2013 Civil works: 34.22%	BSR 2013 Civil works: 34.22%	BSR 2015 Civil works: 34.22%	BSR 2015 Civil works: 34.22%	BSR 2017 Civil works: 34.22%
Trashiyangtse	S/Jongkhar	234 (S/J)	BSR 2013 Civil works: 26.22%	BSR 2013 Civil works: 26.22%	BSR 2015 Civil works: 26.22%	BSR 2015 Civil works: 22.52%	
Trashigang	S/Jongkhar	180 (S/J)				BSR 2015 Building works: 22.84% Bitumen Sealing: 23.79% , Road works: 21.82%, Base Course works: 20.35%	BSR 2017 Building works: 19.84% , Bitumen Sealing: 20.79% Road works: 10.38% Base Course works: 14.88%

There is no consistent approaches in application of cost index in different agencies despite the BSR stipulates procedures for calculation of cost index. The cost index are applied to base rates of Phuentsholing, Samdrup Jongkhar, Gelephu and Thimphu determined in the BSR to cover the cost of making the items available at places of constructions.

For instance, the cost index of Pemagatshel is higher than Trashiyangtse, Trashigang and Mongar which were farther from the base town. Likewise, cost index of Thimphu is higher than Punakha, and Paro as tabulated in the table below:

Dzongkhag	KM from Base Town	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Lhuentse	346 (S/J)	BSR 2013 :34.22%	BSR 2013: 34.22%	BSR 2015 :34.22%	BSR 2015:34.22%	BSR 2017:34.22%
Mongar	271 (S/J)	BSR 2012: 22.04%	BSR 2012: 26.57%	BSR 2015: 21.17%	BSR 2017: 15.45%	
Trashiyangtse	234 (S/J)	BSR 2013: 26.22%	BSR 2013: 26.22%	BSR 2015: 26.22%	BSR 2015: 22.52%	
Trashigang	180 (S/J)				BSR 2015: 22.84%	BSR 2017: 19.84%
Pemagatshel	100 (S/J)	BSR 2013: 19.80%	BSR 2013: 19.80%	BSR 2015: 24.27%	BSR 2015: 24.27%	BSR 2017: 25.28%
Punakha	71 (T)	BSR 2013 : 20%	BSR 2013: 20%	BSR 2015: 20%	BSR 2017	
Paro	54 (T)	BSR 2013: 22%	BSR 2015	BSR 2015	BSR 2017	
Thimphu	0		BSR 2015: 5%	BSR 2015: 5%	BSR 2017	

The RAA also noted that in case of some Dzongkhags, the cost index of places within Dzongkhag are fixed based on distance from the Dzongkhag centre rather than distance from the base town.

1.1.4 Uniform Use of one cost index for all items of works

The Civil and Road works consist of following types of works:

Civil works:

- Building works with Brick infill walls and steel trusses
- Building works with Brick infill walls and timber trusses
- Building works with Stone Masonry infill walls and steel trusses
- Building works with Stone Masonry infill walls and timber trusses
- Site Development works
- Retaining and Breast Walls

Road Works:

- Road Permanent works-Retaining walls, Culverts, and other similar works
- Bitumen sealing works –DBM and AC
- Road Base Course
- Wet Mix Macadam(WMM)

In terms of the BSR, and sample cost indices tables provided in the BSR requires the Government agencies to calculate cost indices for every types of building and road works to arrive at the actual cost of a particular project at a location other than the based town.

Table detailing application of varying cost indices

Name of Dzongkhag	Nearest Base Town	Distance in KM	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Punakha	Thimphu	71(T)	BSR 2013 : 20%	BSR 2013: 20%	BSR 2015: 20%	BSR 2017	
Paro	Thimphu	54(T)	BSR 2013: 22%	BSR 2015	BSR 2015	BSR 2017	
Thimphu	Thimphu	0		BSR 2015: 5%	BSR 2015: 5%	BSR 2017	
HAA	Thimphu	112(T)			Civil-Works: 35.10%	Civil-Works : 35.10%	Civil-Works :30.67%
Gasa	Thimphu	98(T)	Khatoed: 34.20% , Khamoed: 25.36% , Laya: 71.34% Lunana: 100.55%	Khatoed: 34.20% , Khamoed: 25.36% , Laya: 71.34% Lunana: 100.55%	Khatoed: 34.20% , Khamoed: 25.36% , Laya: 71.34% Lunana: 100.55%		
Wangdi	Thimphu	70(T)		BSR 2013 Civil work- 15.39%	BSR 2013 Civil work- 15.39% Base Course 15.39%	BSR 2015 Civil work- 7.01%	
Bumthang	Thimphu	267(T)	BSR 2012 Civil Works: 20.98%	BSR 2012 Civil Works: 20.98%	BSR 2015 Civil Works: 33.49%	BSR 2015 Civil Works: 33.49%	BSR 2017 Building works-bricks:56.40% Building works-stone masonry: 37.44%
Chukha	P'ling	82(P)					BSR 2017: Civil works : 13.01%
Samtse	P'ling	74 (P)		BSR 2013 Civil works-10% (new) Civil works Maintenance : 5%	BSR 2015	BSR2015	
Sarpang	Gelephu	33(G)			BSR 2013	BSR 2015	On BSR 2017: Civil works: 8.38%,
Zhemgang	Gelephu	133(G)	BSR 2012: Road: 17.43% , Building 20.50%		BSR 2015 Building: 20.50%	BSR 2017 Road: 22.28% , Building: 9.95%	
Mongar	S/Jongkhar	271 (S/J)	BSR 2012 Civil works: 22.04% Site Development works: 15.37%	BSR 2012 Civil works: 26.57% Site Development works: 18.62%	BSR 2015 Civil works: 21.17% Site Development works: 17.92%	BSR 2017 Civil works: 15.45% Site Development works: 15.37%	

Pemagatshel	S/Jongkhar	100 (S/J)	BSR 2013: 19.80%	BSR 2013: 19.80%	BSR 2015: 24.27%	BSR 2015: 24.27%	BSR 2017: 25.28%
S/Jongkhar	S/Jongkhar	0	BSR 2012 Jomotsangkha Dungkhag Road works : 32.60% Dewathang Gewog Road works : 13.99% Orong Gewog: Road works : 20.73% Gomdar Gewog Road works : 16.94% Wangphu Gewog Road works : 32.79%	BSR 2012 Jomotsangkha Dungkhag Road works : 32.60% Dewathang Gewog Road works : 13.99% Orong Gewog: Road works : 20.73% Gomdar Gewog Road works : 16.94% Wangphu Gewog Road works : 32.79%	BSR 2012 Jomotsangkha Dungkhag Road works : 32.60% Dewathang Gewog Road works : 13.99% Orong Gewog: Road works : 20.73% Gomdar Gewog Road works : 16.94% Wangphu Gewog Road works : 32.79%	BSR 2012 Jomotsangkha Dungkhag Road works : 32.60% Dewathang Gewog Road works : 13.99% Orong Gewog: Road works : 20.73% Gomdar Gewog Road works : 16.94% Wangphu Gewog Road works : 32.79%	
Lhuentse	S/Jongkhar	346 (S/J)	BSR 2013 Civil works: 34.22%	BSR 2013 Civil works: 34.22%	BSR 2015 Civil works: 34.22%	BSR 2015 Civil works: 34.22%	BSR 2017 Civil works: 34.22%
Trashiyangtse	S/Jongkhar	234 (S/J)	BSR 2013 Civil works: 26.22%	BSR 2013 Civil works: 26.22%	BSR 2015 Civil works: 26.22%	BSR 2015 Civil works: 22.52%	
Trashigang	S/Jongkhar	180 (S/J)				BSR 2015 Building works: 22.84%	BSR 2017 Building works: 19.84%

Although the BSR requires the procuring agencies to calculate and apply cost indices for every types of building and road works to arrive at the actual cost of a particular project at a location other than the based town since Weightage of a particular material is the percentage of its cost from the total cost of the project and weightage differs for different kinds of project.

The agencies had computed and applied a flat cost indices deviating from the stipulated norms. The application of a flat cost index for all types of works tantamount to preparation of inflated cost estimates as well as valuation of additional and deviated works with resultant government agencies paying exorbitant prices.

1.1.5 Inconsistent use of BSR for application of cost indices

The BSR was revised and updated after BSR 2013 every two years one in 2015 and 2017. The review of the application of cost indices over BSR observed inconsistency in the use of BSR as well as application of cost indices. Instances noted are as tabulated in the table below:

Name of Dzongkhag	Distance in KM	2012-2013 (BSR 2013 dated 23.5.2013)	2013-2014	2014-2015 (BSR 2015 dated 6.5.2015)	2015-2016	2016-2017 (BSR 2017 dated 8.5.2017)	2017-2018
Punakha	71 (T)		BSR 2013: 20%	BSR 2013: 20%	BSR 2015: 20%	BSR 2017	
Paro	54 (T)		BSR 2013: 22%	BSR 2015	BSR 2015	BSR 2017	
Thimphu	0			BSR 2015: 5%	BSR 2015: 5%	BSR 2017	
Trongsa	199(T)					BSR 2015: 28.08%	
Wangdi	70(T)			BSR 2013: 15.39%	BSR 2013: 15.39%	BSR 2015: 7.01%	
Bumthang	267(T)		BSR 2012: 20.98%	BSR 2012: 20.98%	BSR 2015: 33.49%	BSR 2015: 33.49%	BSR 2017: 56.40%
Chukha	82(P)						BSR 2017: 13.01%
Samtse	74 (P)			BSR 2013: 10%	BSR 2015	BSR 2015	
Sarpang	33(G)				BSR 2013	BSR 2015	BSR 2017: 8.38%,
Dagana	198(G)		BSR 2013: 21.45%	BSR 2013: 21.45%	BSR 2015: 31.18%	BSR 2015: 31.18%	BSR 2017: 29.49%
Zhemgang	133(G)		BSR 2012: 20.50%		BSR 2015 : 20.50%	BSR 2017: 9.95%	
Tsirang	93(G)		BSR 2012: 18%	BSR 2013: 26%		BSR 2015: 14.08%	
Mongar	271(S/J)		BSR 2012: 22.04%	BSR 2012: 26.57%	BSR 2015: 21.17%	BSR 2017: 15.45%	
Pemagatshel	100(S/J)		BSR 2013: 19.80%	BSR 2013: 19.80%	BSR 2015: 24.27%	BSR 2015: 24.27%	BSR 2017: 25.28%
S/Jongkhar	0		BSR 2012: Dungkhags: 17:15%	BSR 2012: Dungkhags: 17:15%	BSR 2012: Dungkhags: 17:15%	BSR 2012: Dungkhags: 17:15%	
Lhuentse	346(S/J)		BSR 2013: 34.22%	BSR 2013: 34.22%	BSR 2015: 34.22%	BSR 2015: 34.22%	BSR 2017: 34.22%
Trashiyangtse	234(S/J)		BSR 2013 : 26.22%	BSR 2013: 26.22%	BSR 2015: 26.22%	BSR 2015: 22.52%	
Trashigang	180(S/J)					BSR 2015: 22.84%	BSR 2017: 19.84%

There is no consistent approaches in the use of BSR for the application of cost index in different agencies despite the publication of BSR. The varied practices adopted by the agencies result in different cost estimates.

There is no system of validation in the use of BSR and application of cost indices by central authorities as to ensure consistency and uniformity in the adoption of BSR for the application of cost indices. In addition, there is no stipulations on regularity of adoption of such revisions due to which the agencies resort to use of different BSR for computing and application of cost indices.

1.1.6 Flaws and Ambiguity in the derivation of weightage of materials

The BSR defines that the weightage of a particular material is the percentage of its cost from the total cost of the project. It outlined that weightage differs for different kinds of projects and engineers are to calculate weightages using rates of items of the nearest base town. It also outlined that same weightage shall be applicable for similar works at any location.

The material weightages applied for calculation of cost indices for varying types of building and road works by Dzongkhags are as detailed in the table below:

Description	Sample in BSR	Tsirang	T/Yangtse	Trashigang	Chhukha	Lhuentse	Zhemgang	Paro	Punakha	Sarpang	Pemagatshel
	Weight use										
Cement	17.00	17.00	17.00	9.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
steel reinforcement	14.00	14.00	14.00	10.00	14.00	31.50	14.00	14.00	14.00	14.00	14.00
rolled steel	3.00	3.00	3.00	3.00	3.00	23.26	3.00	3.00	3.00	3.00	3.00
CGI sheet	5.00	5.00	5.00	5.00	5.00	6.32	5.00	5.00	5.00	5.00	5.00
Brick/ICEB	9.50	9.50	9.50	5.00	9.50	9.34	9.50	9.50	9.50	9.50	9.50
Stone boulder	1.50	1.50	1.50	5.00	1.50	0.34	1.50	1.50	1.50	1.50	1.50
Rough swan timber	17.00	17.00	17.00	9.00	17.00	3.20	17.00	17.00	17.00	17.00	17.00
Stone aggregates (20mm)	4.50	4.50	4.50	3.00	4.50	6.96	4.50	4.50	4.50	4.50	4.50
sand	2.00	2.00	2.00	4.00	2.00	2.27	2.00	2.00	2.00	2.00	2.00
labour average:											
Category I to IV	11.50	11.50	11.50	25.00	11.50	-	11.50	11.50	11.50	11.50	11.50
Category V	15.00	15.00	15.00	22.00	15.00	-	15.00	15.00	15.00	15.00	15.00
Plumbing/ Sanitary Fittings						0.17					
Total	100	100	100	100	100.00	100	100	100	100	100	100

Description	Sample in BSR	Tsirang Dzongkhag	Trashiyang tse	Punakha Dzo.	Pemagatshel Dzo.
	Weight use				
Cement	17.00	17.00	17.00	17.00	17.00
steel reinforcement	14.00	14.00	14.00	14.00	14.00
CGI sheet	5.00	5.00	5.00	5.00	5.00
Brick/ICEB	10.50	10.50	10.50	10.50	10.50
Stone boulder	1.50	1.50	1.50	1.50	1.50
Rough swan timber	19.00	19.00	19.00	19.00	19.00
Stone aggregates(20mm)	4.50	4.50	4.50	4.50	4.50
sand	2.00	2.00	2.00	2.00	2.00
labour average:					
Category I to IV	11.50	11.50	11.50	11.50	11.50
Category V	15.00	15.00	15.00	15.00	15.00
Total	100	100.00	100.00	100	100

Description	Sample in BSR	Tsirang	Trashiyang tse	Lhuentse	Punakha	Pemagatshel	S/Jongkhar	DoAT (MoC)
	Weight use							
Cement	17.00	17.00	17.00	18.48	17.00	17.00	17.00	17.00
steel reinforcement	5.00	5.00	5.00	11.11	5.00	5.00	5.00	5.00
CGI sheet	8.00	8.00	8.00	9.40	8.00	8.00	8.00	8.00
Brick/ICEB	1.00	1.00	1.00	2.41	1.00	1.00	1.00	1.00
Stone boulder	6.00	6.00	6.00	13.91	6.00	6.00	6.00	6.00
Rough swan timber	22.00	22.00	22.00	38.08	22.00	22.00	22.00	22.00

Stone aggregates(20mm)	3.00	3.00	3.00	1.34	3.00	3.00	3.00	3.00
sand	2.00	3.00	3.00	4.92	3.00	3.00	3.00	3.00
labour average:								
Category I to IV	20.00	20.00	20.00	-	20.00	20.00	20.00	20.00
Category V	15.00	15.00	15.00	-	15.00	15.00	15.00	15.00
Plumbing/Sanitary Fittings				0.34				
Total	100	100.00	100.00	100	100.00	100.00	100.00	100

Table D: Road Permanent works: Retaining walls, Culvert and other similar works

Description	Sample in BSR	T/yang tse	Trashigang	Lhuentse	Punakha	Pemagatshel	S/Jongkhar	DoAT (MoIC)
Weight use								
Cement	30.00	30.00	7.50	29.20	30.00	30.00	30.00	30.00
Steel Reinforcement-Thermo-Mechanically treated (TMTT) bars				13.60				
Stone boulder	20.00	20.00	6.00	34.37	20.00	20.00	20.00	20.00
Rough Sawn timber "class B"				1.25				
Stone aggregates(20mm)	3.00	3.00	5.00	8.84	3.00	3.00	3.00	3.00
Sand	5.00	5.00	4.50	12.74	5.00	5.00	5.00	5.00
labour average:								
Category I to IV	16.00	16.00	35	-	16.00	16.00	16.00	16.00
Category V	26.00	26.00	42	-	26.00	26.00	26.00	26.00
Total	100	100	100	100	100	100	100	

Table E: Bitumen sealing works

Description	Sample in BSR	Tsirang/T/yangtse/Punakha / Sarpang /Pema - gatshel	Trashigang	Lhuentse	RO, Lobeyasa	Regional Office, DOR, Trongsa (DBM & AC works)	S/Jongkhar Dzongkhag		
							Weight use		
Bitumen	63.00	63.00	53.00	53.16	45.27	Labour	1.71	Roller CAT CS551	2.09
Road roller (8-10T)	9.00	9.00	2.00	8.09	9.61	Road Broom (TD -96)	0.01	Bitumen 80/100	45.26
Fire wood	3.00	3.00	2.00		25.01	Bitumen 80/100	77.05	Fire wood	1.68
Stone aggregates (20mm)	14.00	14.00	6.00	7.40	8.08	Roller, CAT - CS551	1.65	63mm agg	0.92
Stone Boulder				20.52		Road Roller (Pneumatic tyre), TS-300	0.72	50mm agg	0.87
Sand (binding Materials)				10.84	1.10	Road Roller (SV91, Sakai)	0.77	40mm agg	0.89
labour average:				-		Asphalt Paver	0.18	10mm agg	7.09

Category I to IV	0.50	0.50	20.50	-	0.25	Tractor with trailer, Toyota	0.04	Sand	0.50
Category V	10.50	10.50	16.50	-	10.68	Spot Mix Plant, 10/16 TPH	5.88	Labor : Average	
Total	100	100.00	100	100		Pay loader (cat 928F)	1.91	Category I-IV	0.11
						TATA tipper 1612SE	1.38	Category V	40.59
						Compactor, plate type	0.64		100
						Asphalt/Bitumen Sprayer (Hino)	0.38		
						Asphalt/Bitumen Heating kettle, India make	0.27		
						Crushed rock, 20 mm	1.75		
						Crushed rock , 12.5 mm to 6mm (preferably 10 mm)	3.72		
						Sand	1.94		
						Labour	1.71		

Table F: Road works: Base Course

Description	Sample in BSR	Trashiy angtse	Trashig ang	Lhuentse	Zhemgang	Punakha	Sarpang	Pemagatshel
	Weight use							
Stone boulder	5.00	5.00	6.50	20.52	5.00	5.00	5.00	5.00
Road Roller (8-10T)	32.00	32.00	2.00	8.09	32.00	32.00	32.00	32.00
Binding materials	3.75	3.75	7.50	10.84	3.75	3.75	3.75	3.75
Stone aggregates (20mm)	42.00	42.00	7.50	7.40	42.00	42.00	42.00	42.00
Bitumen 80/100 or Emulsion				53.16				
labour average:								
Category I to IV	0.25	0.25	29.50	-	0.25	0.25	0.25	0.25
Category V	17.00	17.00	47.00	-	17.00	17.00	17.00	17.00
Total	100	100	100	100	100	100	100	100

Description	Lhuentse Weight use
Cement	17.55
steel reinforcement	1.65
CGI sheet	17.13
Brick/ICEB	2.57
Stone boulder	8.76
Rough swan timber	44.39
Stone aggregates (20mm)	2.67
Sand	4.82
Labour average:	
Category I to IV	-
Category V	-
Plumbing/Sanitary Fittings	0.47
Total	100

Description	Lhuentse Weight use
Cement	29.98
Steel Reinforcement-	5.65
Stone boulder	5.32
Stone aggregates (20mm)	12.30
Sand	4.13
labour average:	
Category I to IV	-
Category V	-
HDPE Pipes	30.57
GI Pipes	12.06
Total	100

Description	Lhuentse Weight use
Cement	30.86
Steel Reinforcement-	2.96
Stone boulder	2.55
Stone aggregates (20mm)	11.71
Sand	9.52
labour average:	
Category I to IV	-
Category V	-
HDPE Pipes	42.39
Total	100

The RAA noted following issues in the weightages derived for the materials and application for calculation of cost indices:

- a) There is inconsistent approaches in use of weightages of materials for calculation of cost index despite stipulated procedures and requirement for the calculation of weightages using rates of items of the nearest base towns for different kinds of projects.
- b) It would be apparent from the tables above that except two Dzongkhags viz. Trashigang and Lhuentse, rest had used the same weightages of materials provided in the Sample Tables in the BSR for all types of building and road works.
- c) The use of same weightages of materials provided in the Sample table of BSR indicated ambiguity and flaws in the use of weightages as the weightage of a particular material is the percentage of its cost from the total cost of the project.
- d) The BSR categorically stipulated that Weightage differs for different kinds of projects, thus use of weightages given in the sample may have cost implications in the preparation of cost estimates of the project or valuation of variations and additional works.
- e) The labour cost is the major component of the cost of the project. While the BSR has provided weightages for the labour cost in the Sample provided for calculation of cost indices, Lhuentse Dzongkhag has not considered and provided weightages for labour cost for calculation of cost indices inflating the cost indices to the extent of weightages for labour cost represented in the total cost of the project.
- f) The weightages derived and applied in respect of some materials by Lhuentse Dzongkhag were either abnormally higher or lesser than the weightages assigned in the Sample and applied by other Dzongkhags. Instances are as shown below:

Description	Building works with brick infill walls and steel trusses		Building works with stone masonry infill wall		Bitumen sealing works		Road Permanent works: Retaining walls, Culvert & other similar works		Base Course	
	Weightage Assigned									
	Sample/ other Dzongkhags	Lhuentse	Sample/ other Dzongkhags	Lhuentse	Sample/ other Dzongkhags	Lhuentse	Sample/ other Dzongkhags	Lhuentse	Sample/ other Dzongkhags	Lhuentse
steel reinforcement	14.00	31.00	5.00	11.11			0.00	13.60		
rolled steel	3.00	23.26	6.00	13.91						
Stone Aggregates	4.50	6.96	3.00	1.34	14.00	7.40	3.00	8.84	42.00	7.40
Rough timber	17.00	3.20	22.00	38.08			0.00	1.25		
Sand			2.00	4.92	0.00	10.84	5.00	12.74		
Bitumen					63.00	53.16			0.00	53.16
Stone Boulder					0.00	20.52	20.00	34.37	5.00	20.52
Road Roller									32.00	8.09
Binding material									3.75	10.84

Inconsistencies in weightages for materials for similar types of building and road works tantamount to flaws and ambiguous in the assignment of weightages leading to preparation of unrealistic estimated cost of the project and inflated valuation of cost for variations and additional works.

- g) Similarly, the weightages derived and applied in respect of materials by Trashigang Dzongkhag were also no consistent with the weightages provided in the Sample in the BSR and applied by other Dzongkhags as shown below:

Description	Building works with brick infill walls and steel trusses		Bitumen sealing works			Road Permanent works: Retaining walls, Culvert and other similar works			Base Course			
	Weightage Assigned											
	Sample/ other Dzongkhags	Trashigang Dzongkhag	Description	Sample/ other Dzongkhags	Trashigang Dzongkhag	Description	Sample/ other Dzongkhags	Trashigang Dzongkhag	Description	Sample/ other Dzongkhags	Trashigang Dzongkhag	
Cement	17.00	9.00	Bitumen	63.00	53.00	Cement	30.00	7.50	Stone boulder	5.00	6.50	
steel reinforcement	14.00	10.00	Road Roller (8-10T)	9.00	2.00	Stone boulder	20.00	6.00	Road Roller (8-10T)	32.00	2.00	
rolled steel	3.00	3.00	Fire wood	3.00	2.00	Stone aggregates 20mm	3.00	5.00	Binding materials	3.75	7.50	
CGI sheet	5.00	5.00	Stone aggregates 20mm	14.00	6.00	Sand	5.00	4.50	Stone aggregates 20mm	42.00	7.50	
Brick/ICEB	9.50	5.00	labour average			labour average			labour average			
Stone boulder	1.50	5.00	Category I to IV	0.50	20.50	Category I to IV	16.00	35	Category I to IV	0.25	29.50	
Rough swan timber	17.00	9.00	Category V	10.50	16.50	Category V	26.00	42	Category V	17.00	47.00	
Stone aggregates (20mm)	4.50	3.00	Total	100	100	Total	100	100	Total	100	100	
Sand	2.00	4.00										
Labour average:												
Category I to IV	11.50	25.00										
Category V	15.00	22.00										
Total	100											

- h) The Regional Office, DOR, Trongsa has calculated the cost index for item of works -BDM & AC by assigning weightages on labour and material coefficient detailed for the item of work while all Dzongkhags had assigned weightages as per Sample provided in the BSR for bitumen sealing works. This varying processes indicated absence of uniformity and consistency in the calculation of cost index.
- i) The table above also indicated that weightage assigned to particular materials substantially differed from the weightages assigned in the BSR Sample and applied by other Dzongkhags.
- j) In particular, the weightages assigned to labour average cost for two categories was 25 and 22 as against assigned weightages of 11.50 and 15.00. Such inconsistencies indicated flaws in the weightages assigned by either Trashigang Dzongkhag or assigned in the BSR sample and other Dzongkhags.
- k) Inadequate enforcement mechanism in procuring agencies:
- Absence of built up item rate (Base rates) for respective Dzongkhag and Gewog locations
 - Roles and responsibilities of technical personnel responsible for preparation and approving of Cost indices
 - Monitoring at national and at procuring agency level on the calculation and application of cost indices over the base town rates.

As a result, shortcomings and lapses in adoption of procedures in the calculation and application of cost indices will continue to surface across the procuring agencies.

1.1.7 Non-assignment of Weightage for labour cost

The labour cost is the major component of the cost of the project. While the BSR has provided weightages for the labour cost in the Sample provided for calculation of cost indices, Lhuentse and Trashy Yangtse Dzongkhags have not considered and provided weightages for labour cost for calculation of cost indices. Instances of weightage assignment to other materials only are as tabulated in the table below:

Weightage assigned for Semi permanent Building Works (Lhuentse)							
Sl. No	Item	Qty	Unit	Rate	Amount	Average cost	Weightage = (Average cost / Total cost)*100
	1	2	3	4	5	6	7
1	Cement (OPC / PSC)	22.96	tonne	6088.50	139,791.96	139,791.96	17.55
2	Steel Reinforcement- Thermo - Mechanically Treated (TMT) bars (yield strength 500 MPa)	219.72	kg	59.67	13,110.69	13,110.69	1.65
3	C.G.I Corrugated G.I Sheets - 24G (0.63mm)	1.90	tonne	72000.00	136,800.00	136,800.00	17.17
4	Brick/ICEB	1.92	1000#	10660.00	20,467.20	20,467.20	2.57
5	Stone Boulders	124.67	cu.m	559.82	69,792.76	69,792.76	8.76
6	Rough Sawn Timber - Class 'B', (Mixed Conifer)	33.806	cu.m	10459.68	353,599.94	353,599.94	44.39
7	Stone Aggregates	18.529	cu.m	1147.60	21,263.88	21,263.88	2.67
8	Crushed Rock - 12.5 - 6mm	0.41807	cu.m	1103.61	461.39	461.39	
9	Crushed Rock - 20mm	8.23	cu.m	1147.60	9,444.75	9,444.75	
10	Crushed Rock - 40mm	15.72	cu.m	953.48	14,988.71	14,988.71	

11	Sand	65.96	cu.m	581.48	38,354.42	38,354.42	4.82
12	Plumbing/Sanitary Fittings						
13	H.D.P.E pressure class 10kg/sq.cm - 25mm	45.00	m	54.00	2,430.00	3,725.68	0.47
14	G.I Pipe -15mm	24.00	m	101.67	2,440.08		
15	P.V.C pipe-110mm-1.83m long	35.00	m	237.70	8,319.50		
16	P.V.C pipe-75mm-1.83 m long	11.00	m	155.74	1,713.14		
Total						796522.38	100.0

Permanent Road Works (Gabion walls, RRM retaining wall, cause way, Hume pipe, stone soling, etc) (Lhuentse)							
Sl. No	Item	Qty	Unit	Rate	Amount	Average Cost	Weightage= (Average cost /Total cost)*100
1	Cement (OPC / PSC)	28.35	tonne	6088.50	172,608.98	172,608.98	20.81
2	Steel Reinforcement, Thermo - Mechanically Treated (TMT) bars (yield strength 500 MPa)	2703.48	kg	59.67	161,316.65	161,316.65	19.44
3	Stone Boulders	676.37	cu.m	559.82	378,645.45	378,645.45	45.64
4	Stone Aggregates -20 mm	47.29	cu.m	1147.60	54,270.00	54,270.00	6.54
5	Sand	107.98	cu.m	581.48	62,788.21	62,788.21	7.57
Total Cost						829,629.29	100.00

Weightage For External Water Supply Works						
Sl. No	Item	Qty	Unit	Basic Rates	Amount (1*3)	Weightage = (4 /Total cost)*100
1	Cement (OPC / PSC)	11.54	tonne	6088.5	70,281.55	50.49
2	Steel Reinforcement (TMT)	4.84	kg	59.67	288.56	0.21
3	Stone Boulders	0.00	cu.m	559.82	0.00	0.00
4	Stone Aggregate	6.26	cu.m	1147.6	7,188.57	5.16
5	Sand	5.90	cu.m	581.48	3,428.73	2.46
6	HDPE Pipe - 50 mm,40mm,32mm,25mm	361.89	m	111.125	40,214.80	28.89
7	GI pipe-15mm,20mm,25mm	125.00	m	142.45	17,806.25	12.79
Total Cost:					139,208.47	100

Weightage of a particular material is the percentage of its cost from the total cost of the project and labour cost being the major component of the project cost, non-inclusion for calculation of weightages had inflated the weightages of other materials. Thus the calculation and application of cost indices had resulted into inflated estimated cost of the project.

1.1.8 Use of CDCL Hiring rates for equipment and machineries

The BSR has incorporated the hire charges for plant and machineries based on the built up rates provided by the Construction Development Corporation Limited, (CDCL) Thimphu.

The CDCL built up rates are built up rates taking into accounts CDCL's direct cost, depreciations, operating cost, overhead cost administrative expenses and contingencies of the CDCL. Thus, the CDCL hiring rates are applicable if the CDCL plants and machineries are hired and deployed for the related works.

The use of CDCL hire charges for the calculation of cost indices and rate analysis would systematically limit the competition and would benefit the prospective bidders and contractors by way for inflated project estimates particularly awarding direct contracts and additional works of huge magnitude project

By limiting hiring charges to CDCL impedes the objective of obtaining competitive and prevailing market rates for plant and machineries. The application of CDCL hiring charges may hold water if the CDCL plants and machineries are hired and deployed for the related works.

1.1.9 Use of NRDCL rates for aggregates stones although contractors are allowed to operate stone quarry for the contract works

The BSR provides basic rates of materials but stipulates that users are to update rates accordingly with the prevailing market rates.

The RAA observed that there were no consistent approaches in the obtaining of rates of materials. For the calculation of cost indices, government agencies have use rates of aggregates stones obtained during annual quotation/tenders, base rates of BSR, NRDCL rates and rates provided by the contractors.

The government agencies has use rates for calculation of cost indices obtained under various methodology even on the stipulation of conditions for allowing operation of stone quarry at work sites in the tender documents.

In the absence of standard in obtaining of rates of material from the market and use of NRDCL rates, varying practices prevailed in the obtaining rates of materials and application in the calculation of cost indices.

1.1.10 Inadequacy in the obtaining material rates at the location

In terms of the BSR, the procedure for calculation of rates of the project location outlined that “To derive the approximate item rate at any location, the BSR item rates of the nearest base town shall be enhanced by the cost index”. While the weightage required for a particular materials is worked out in terms of percentage of its cost from the total cost of the project, the rates of materials at the project locations are either computed based on distances from the base town and transportation cost per km or on the following prices:

- a) Annual quotation rates/Framework contract rates
- b) Material Prices of agents/suppliers/ quarry operators/sawmills viz, cement, aggregates, construction materials, timber
- c) Prices quoted by contractors
- d) For machineries and equipment, hiring rates of CDCL
- e) For aggregates and boulder, selling rates of NRDCL
- f) Lhuentse Dzongkhag had used region-wise selling rate for cement approved by Dungsam Cement Corporation Ltd vide notifications posted on <http://www.dcll.bt>
- g) For other Materials, Lhuentse Dzongkhag had used transportation cost collected from different firms.
 - Example: Nu. 24,500/Truck from base town till Lhuentse.

- One truck load carries 8 MT, then the transportation cost from S/Jongkhar to Lhuentse = 24500 (Average from collection of transportation cost from contractors)
 - Total loading & unloading charge for per truck load is Nu. 3000 (Nu. 1500 for loading & Nu. 1500 for unloading).
 - Total cost for transportation inclusive of loading & unloading is = $24500+3000 = \text{Nu. } 27,500$. therefore for 1 MT transportation cost= $27500/8=3437.5$
 - Therefore the cost of Steel Reinforcement at Lhuentse = $596670+3437.5= \text{Nu. } 63107.50/\text{MT}$
 - For Road Roller = Rates collected from different firms. i.e. Nu. 1500/hour at Lhuentse. The standard working hour is considered for 8 hours and therefore the cost per day shall pertained to $\text{Nu. } 8*1500=12000/-$ per day
- h) For material rates at the project location, Trashiyangtse Dzongkhag had used base rate plus transportation cost for steel reinforcement, rolled steel and CGI Sheet and Brick.
- i) Tsirang Dzongkhag had used average price of all materials prevailing at the locations.
- j) Ro, Lingmethang had used various hiring rates of machinery and equipment of other hiring agents prevailing at the locations.
- k) While some Dzongkhags and agencies had used average prevailing market labour rates, the agencies had used the national minimum wage rate in estimating the labour costs whereas the market price of labour are substantially higher resulting in underestimation of project cost and cost overruns.
- l) In addition, the rates are collected directly from the market (dealers/suppliers) through informal enquiry. There is no formal procedures adopted as to obtaining through competitive basis or obtaining prices from minimum dealers/suppliers. The spread of suppliers/vendors are not ensured to reflect the overall market price. Hence the market prices determined and incorporated in the base rates may not be realistic or reflective existing market prices.

It is apparent from the above instances highlighted that Procurement agencies had used various procedures and practices in the derivation of rates of materials at the project locations. Absence of standard procedures and practice in the derivation of rates of materials at the location, there would be flaws and ambiguities in the calculation of cost indices at the project locations with huge financial implication to the government exchequers.

Thus, the realistic calculation of cost indices at project locations would purely depend on the correct processes for the collection of materials prices and derivation of materials rates at the project locations.

1.2 Issues relating to Rates Analysis

1.2.1 No standard format and inadequacy in obtaining material rates for carrying out material rate analysis

Review of rate analysis documents and analysis of samples for materials and item of work rate analysis revealed adoption of various practices by the government agencies. There is a lack of consistency in carrying out of rate analysis in the absence of proper guidelines, standard format and procedures and provided discretion to the individuals carrying out the rate analysis. Instances

of varying procedures and practices adopted in carrying out the rate analysis are tabulated in the tables below:

Lhuentse Dzongkhags							
Analysis rate for 20mm crushed rock							
Step i). Calculations of volume of 20mm crushed rock to be carried/transported in a day							
Activities	unit	No.	Qty	T/time/Distance	Rate	Amount	Remarks
The volume of 20mm chips to be carried per truck(V)=	cu m	1.0	8				
Lead of work site(section) from the Crushing unit at Kilikhar (to & fro)	km	2.0	106	212			
Loading/unloading time	hr	1.0			Refer lab & materials coefficient		
Speed of Vehicle in Hill road	km/hr		27.5				
Total Time taken for 1 trip to the site.	hrs			8.71			
Hire charge of Tata Tipper(1612 SE)/hr with HSD	Nu/hr				396.00	3448.8	Hiring rate
Hire charge of Tata Tipper (1613 SE) with HSD for 1 Cu.m	Nu/Cum					431.1	
Step iii) Cost of 1Cum/ 35.31 cft of stone chips 20mm							
(B). Prevailing Cost of 1 cft of aggregate at Kilikhar crushing unit,(loading charges)				Nu	22		
Cost per Cu.m				Nu.		776.82	
Total cost for 1 cum aggregate				Nu/Cum		1207.92	Nu/Cum

RO, Lingmethang							
Analysis rate for 20mm crushed rock							
Step i). Volume of Chips per trip per truck							
The volume of 20mm chips to be carried per truck (V) =	cu m		8.0	7.4			
Activities	unit	No.	Distance	Distance	Rate	Amount	Remarks
Step ii). Hire charge calculation for one trip							
Lead distance from crushing unit to work site	km	2.0	44.00	88			7.5% void deduction
Loading/unloading time	hr	1.0	1.0		As per LMC 2017		
Speed of Vehicle in Hill road	km/hr	1.0	27.5		As per LMC 2017		
Total Time taken for 1 trip to the site.	hrs	1.0		4.200			
Hire charge of Tata Tipper(1612 SE)/hr with HSD	Nu./hr				448.99		NSD Hiring
Hire charge of Tata Tipper (1612 SE)/day with HSD	Nu./day	1.0		8			
Total Hire charge for Tata tipper -1612 SE(Hc)/trip	Nu./trip	1.0				3,591.92	
Step iii). cost of 1Cum/ 35.315 cft of stone chips 20mm							
(A).Transportation charge per cum of aggregates	Nu					485.4	
(B). Prevailing Cost of 1 cft of aggregate	Nu				34.0		Crushing Unit,Tsenkari
Cost per Cum	Nu.					1,200.71	
Total cost for 1 cum aggregate (Nu/Cum)						1,686.10	Nu./Cu.m

Lhuentse Dzongkhags							
<i>Analysis rate for Bitumen 80/100</i>							
Step i). Calculations of volume of Bitumen to be carried/transported in a day							
Activities	unit	No.	Qty	T/time/Distance	Rate	Amount	Remarks
The volume of Bitumen 80/100 to be carried per truck(V)=	cu m	1	8				
Step ii). Hire charge calculation for one trip							
Lead of work site(section) from the Regional Store, Lingmethang (to & fro)	km	2.0	107	214			
Loading/unloading time	hr	1.0			Refer lab & materials coefficient		
Speed of Vehicle in Hill road	km/hr		27.5				
Total Time taken for 1 trip to the site.	hrs			8.78181818			
Hire charge of Tata Tipper(1612 SE) for 1 Cu.m	Nu/hr				396.00	3477.6	
Transportation cost for 1 Cum	Nu/day			8		434.7	Hiring rate
Step iii). cost of 1Cum/ 35.31 cft of stone boulder							
(A).Transportation charge per cum of aggregates				Nu		434.7	
(B). Prevailing Cost of 1 mt of bitumen at Lingmethang RO store(loading charges)				Nu	55644.11	55644.11	RO store
Total cost for 1 MT of Bitumen 80/100				Nu/Cum		56,078.81	Nu/Mt

DOR, Pemagatshel Sub Divisions		
<i>Analysis rate for Bitumen 80/100</i>		
Rate of Bitumen 80/100 from RO, Phuentsholing =	42,928.00	Nu per MT
Transportation cost at Plain Road		
Distance from Phuentsholing to RO, Samdrup Jongkhar =	360.00	km
Average speed =	50.00	km per hour
No of trips in 8 hour (X) = $8/(a+1)$; $a=2d/s$ =	0.52	say 1 trip
No of kms covered in 8 hours shift = $2Xd+8$ =	382.03	km
Cost of loading, unloading & stacking-4 laborers for 8 hours @Nu. 215 per day =	860.00	Nu
Hire charge of truck with fuel per day (449*8) =	3,592.00	Nu
Total Cost =	4,452.00	Nu
Cost per trip on plain road =	8570.10	Nu
Carrying capacity of Truck per trip =	8.00	MT
Net quantity payable after deduction of voids =	8.00	MT
Rate per unit =	1071.26	Nu per MT
Transportation cost at Hill Road		
Distance from Samdrup Jongkhar to work site =	186.88	km
Average speed =	25.00	km per hour
No of trips in 8 hour (X) = $8/(a+1)$; $a=2d/s$ =	0.50	say 1 trip
No of kms covered in 8 hours shift = $2Xd+8$ =	195.46	km
Cost of loading, unloading & stacking-4 laborers for 8 hours @Nu. 215 per day =	860.00	Nu
Hire charge of truck with fuel per day (449*8) =	3,592.00	Nu
Total Cost =	4,452.00	Nu
Cost per trip on hill road =	8876.40	Nu
Carrying capacity of Truck per trip =	8.00	MT
Net quantity payable after deduction of voids =	8.00	MT
Rate per unit =	1109.55	Nu per MT
Total cost =	45,108.81	Nu per MT

Dewathang, S/J Dzongkhags		
Analysis rate for Bitumen 80/100		
Rate of Bitumen 80/100 from RO, Phuentsholing =	42,928.00	Nu per MT
Transportation cost on Plain Road		
Distance from Phuentsholing to RO, Samdrup Jongkhar	360.00	km
Average speed =	50.00	km per hour
No of trips in 8 hour (X) = $8/(a+1)$; $a=2d/s$ =	0.52	say 1 trip
No of kms covered in 8 hours shift = $2Xd+8$ =	382.03	km
Cost of loading, unloading & stacking-4 laborers for 8 hours @Nu. 215 per day =	860.00	Nu
Hire charge of truck with fuel per day (449*8) =	3,592.00	Nu
Total Cost =	4,452.00	Nu
Cost per trip on plain road =	4452.00	Nu
Carrying capacity of Truck per trip =	8.00	MT
Net quantity payable after deduction of voids =	8.00	MT
Rate per unit =	556.50	Nu per MT
Total cost for Bitumen 80/100 =	43,484.50	Nu per MT

Derivation of material rates for Gomdar (SPBD)		
MT0244:G.I Chain-link mesh		
Cost of G.I Chain-link at Samdrup Jongkhar for 8 MT	2,964,344.37	<i>Nu.559.52/Sq.m(Quotation from Suresh hardware)</i>
Transportation charges per day for 8 MT	4,480.00	<i>MP00211 Truk/tipper (BSR 2015)</i>
Transportation charges upto site for 8 MT (1 trip)	4,480.00	
Loading charges for 8 MT	300.00	
Unloading charges for 8 MT	150.00	
Cost of G.I Chain-link at site for 8 MT	2,969,274.37	
Cost of G.I Chain-link at site per Sq.m	560.45	<i>1sq.m = 1.51kg</i>
MT0244:G.I Chain-link mesh		

Derivation of material rates for Gomdar (SPBD)		
MT0145: Cement		
Cost of cement at Samtse for 200 bags	61,000.00	
Transportation charges to site for 200 bags per day	4,480.00	<i>MP00211 Truck/tipper (BSR 2015)</i>
Transportation charges to site per day (1 trip)	4,480.00	
Loading charges for 200 bags	200.00	
Total cost of cement at site for 200 bags	65,680.00	
Total cost of cement at site per MT	6,568.00	

Dewathang , Dzongkhag S/J		
Cement		
Rate of cement at depot	6,320.00	Nu. per MT
Distance from Samdrup Jongkhar to worksite	66.12	km
Average speed =	25.00	km per hour
No of trips in 8 hour (X) =	1.27	say 1 trip
No of kms covered in 8 hours shift = $2Xd+8$ =	176.20	km
Cost of loading, unloading & stacking-4 laborers for 8 hours @Nu. 215 per day =	860.00	Nu
Hire charge of truck with fuel per day (483*8) =	3864.00	Nu
Total Cost =	4724.00	Nu
Cost per trip =	4724.00	Nu
Carrying capacity of Truck per trip =	8.00	cu.m
Net quantity payable after deduction of voids =	8.00	cu.m
Cost per MT =	590.50	Nu per MT
Therefore, rate of cement per MT =	6,910.50	Nu per MT

DOR, Pemagatshel Sub-Division		
Cement		
Rate of cement at depot	6,320.00	Nu. perMT
Distance from Samdrup Jongkhar to worksite	186.88	km
Average speed =	25.00	km per hour
No of trips in 8 hour (X) =	0.50	
No of kms covered in 8 hours shift = 2Xd+8 =	195.46	km
Cost of loading, unloading & stacking-4 laborers for 8 hours @Nu. 215 per day =	860.00	Nu
Hire charge of truck with fuel per day (483*8) =	3864.00	Nu
Total Cost =	4724.00	Nu
Cost per trip =	9418.71	Nu
Carrying capacity of Truck per trip =	8.00	cu.m
Net quantity payable after deduction of voids =	8.00	cu.m
Cost per MT =	1177.34	Nu per MT
Therefore, rate of cement per MT =	7,497.34	Nu per MT

Tsirang Dzongkhags					
Agent/Quoted rates	M/s Sunshine Cement Agent Damphu	M/s Nima Lhamo Cement Agent Damphu	M/s R.D.P. Construction, Tsirang	M/s Damchen Stone Crushing Unit Taksha	Average Rate
Cement (MT)	6915.80	6800.00			6857.90
Bitumen 80/100 (MT)					57,630.00
Stone Agg (20mm) (Cum)	1455.00	1412.56	1353.7	1200.67	1355.48
Labour: Average (day)					
Cat: I to IV			500		500
Cat: V			400		400

Trashhi Yangtse Dzongkhags			
Agent/Quoted rates	Cement Agent Trashhi Yangtse	NRDCL T/Yangtse	
Cement (MT)	7800.00		Cement Agent S/J and Master Cement Trashhi Yangtse
Bitumen 80/100 (MT)	56,100.00		Base + Transportation
Stone Agg (20mm) (Cum)		1571.43	Contractor S/J / NRDCL T/Yangtse
Labour: Average (day)			
Cat: I to IV		600	Contractor
Cat: V		400	Contractor

Zhemgang Dzongkhags					
Agent/Quoted rates	Cement Agent Zhemgang	NRDCL T/Yangtse	Annual Quotation for FY 2017-2018	Dungkar Construction	Remarks
Cement (MT)	7472.00				Dechen Wangdi Cement Agent Zhemgang
Steel Reinforcement (MT)			49000.00		M/s Zhemgang Enterprise, Annual Quotation for FY 2017-2018
Stone Agg (20mm) (Cum)		1340.93			NRDCL Zhemgang
Road Roller (8-10MT) (day)				3700.00	

Labour: Average (day)					
Cat: I to IV			400		Average rates collected from Contractors of Zhemgang Dzongkhag
Cat: V			300		Average rates collected from Contractors of Zhemgang Dzongkhag

1.2.2 No standard format for carrying out item of work rate analysis

RO Lingmethang						
Item Code	Code	Description of works	Coefficient	Unit	Base Rate	Amount
	CW0011	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:5:10 (1 cement: 5 sand: 10 graded crushed stone 40 mm nominal size.		Cum		
	LB0036	Mason Gd.1	0.06250	day	286.00	17.88
	LB0039	Work Supervisor (Lajab)	0.05000	day	286.00	14.30
	LB0051	Mason Gd.2	0.06250	day	254.00	15.88
	LB0053	Plant Operator Gd.3	0.07000	day	254.00	17.78
	LB0077	Labour	1.42500	day	215.00	306.38
	MP0205	Concrete Mixer (7/5 cu.ft)	0.07000	day	6576.00	460.32
	MP0206	Concrete Vibrator (M/C5)	0.07000	day	800.00	56.00
	MT0043	Sand	0.47500	Cu.m	409.99	194.74
	MT0070	Crushed Rock-40mm	0.66230	Cu.m	1274.97	844.41
	MT0071	Crushed Rcock-20mm	0.25830	Cu.m	1632.49	421.67
	MT0145	Cement (OPC/PSC)	0.13100	Tonne	7234.38	947.70
					Total	3,297.06
		Add:				
		Inherent wastages on labour, tools & plants & equipment			5%	164.85
		Sub-Total				3,461.91
		Water charges			1%	34.62
		Sub-Total				3,496.53
		Overhead charges			10%	349.65
		Grand Total			16%	3,846.18

SPBD RATE ANALYSIS (for Motithang HSS)						
EW0046-1:Earth work in excavation over areas by Dozer including levelling and dressing - All kinds of soils						
Detail of cost for			1.000 cum			
Code	Description	Quantity	Unit	Rate	Amount	Remarks
Labour						
LB0039	Work Supervisor (Lajab)	0.00330	day	309.82	1.02	As per BSR 2017 EW0046
	Sub Total:				1.02	
Material						
MP0208	Bull Dozer (IH TD20E)	0.00370	day	18,261.60	67.57	As per BSR 2017 EW0046
	Sub Total:				67.57	
	Sub Total:				68.59	
XA010	Over Head Charge on Labour:	5.00 %	%		0.051	
XB010	Over Head Charge on Material :	5.00 %	%		-	
	Sub Total:				68.64	
	Water Charges :	1.00 %	%		0.69	
	Sub Total:				69.33	

	Over Head Charges and Profit :	10.00 %	%		6.93
	Total Amount (Nu.)	26%			76.26

Although the BSR requires to exercise due diligence in inquiring the prices and compare with the market prices, the procuring agencies generally do not conduct market surveys but rates at the project locations are either based on annual quotations (sometimes on single quoted rates) or rates of the single supplier prevailing in the market of the locations. This had defeated the intent of public procurement in obtaining the competitive price and had resulted in government agencies paying exorbitant prices.

The review of sample rate analysis highlighted the following ambiguities and deficiencies:

- a) The material cost at project locations were assigned based on annual quotations, Base rate plus transportation, NRCDL rates, individual crushing unit rate for aggregates, individual cement agent rate, average rates of cement agents, average rates of suppliers for construction materials
- b) Hiring charges of machinery were assigned based on individual hiring cost, and CDCL hiring rates
- c) The labour rates were based on average labour cost charged by various contractors, rates of individual contractor
- d) There was no percentage ceiling fixed for wastage and overhead charges applicable during rate analysis for item of works

Existence of varying procedures and practices could be attributed to lack of proper guidelines and procedures outlined in the in the BSR and absence of monitoring mechanism over by appropriate authorities.

It is possible that in absence of any check and control in the calculation and application of cost indices, preparation of cost estimates for projects as well as valuation of cost for additional and deviated works may tantamount to inflation of cost of project works with undue benefit to the contractors. This may also result into engagement of unethical processes and practices siphoning the government scarce resources.

There needs to be uniform procedures along with standard format which can be consistently followed in carrying out of rate analysis.

1.3 Rate analysis not aligned with Labour and Material Coefficient (LMC)

The Regional Offices, Department of Road for the Up-gradation Project Northern East-West Highway had obtained Rate Analysis for the following item of works since the Bitumen was issue free of cost from the prospective bidders:

- a) *“Providing and Laying Dense Bituminous Macadam (DBM) to required degree of compaction based on mix design (job mix formula) approved by the supervising engineer including preparation of surface with road broom, application of prime coat @ 0.75 kg/sq.m by mechanized method using asphalt plant, paver, vibratory roller, steel roller, etc. complete – 75mm thick”.*
- b) *“Providing and Laying Asphalt/Bituminous Concrete to required degree of compaction based on the job mix design approved by the supervising engineer using asphalt plant, paver, steel*

roller, vibratory roller, pneumatic roller etc. as per material gradation and aggregate quality specified. 50 mm thick”

The review of the Rate Analysis of the winning bidders noted flaws and ambiguities in the application of labour and material co-efficient as the co-efficient used by the winning bidders were not aligned with the co-efficient assigned in the LMC. Further, there were not basis of the derivative of the co-efficient used for labour and materials in the rate analysis.

Cases noted use of varying co-efficient for labour and materials by the contractors including varying percentage of overhead cost, contractor profit, installation of labour camps etc. are tabulated below:

Description DBM 75mm	Quant	Units	Quant used by contractors					
			Package 2	Package 9	Package 1	Package 4	Package 7	Package (Gongphel)
Labour	0.05120	day	0.05000	0.05478	0.05120	0.05120	0.05120	0.05120
Road Broom	0.00007	day	0.00074	0.00008	0.00007	0.00007	0.00007	0.00007
Tractor with trailer	0.00007	day	0.00070	0.00008	0.00007	0.00007	0.00007	0.00007
Asphalt heating kettle	0.00062	day	0.00600	0.00066	0.00062	0.00062	0.00070	0.00062
Bitumen sprayer	0.00045	day	0.00450	0.00048	0.00045	0.00045	0.00045	0.00045
Spot mix plant	0.002475	day	0.003000	0.00247	0.002475	0.002475	0.00245	0.00264
Generator & control panel	0.00000			0.00247				
Asphalt paver	0.00014	day	0.00010	0.00015	0.00014	0.00014	0.00014	0.00014
Road roller	0.00045	day	0.00045	0.00048	0.00045	0.00045	0.00045	0.00045
Pneumatic roller	0.00045	day	0.00045	0.00048	0.00045	0.00045	0.00045	0.00045
Pay loader	0.00091	day	0.00091	0.00097	0.00091	0.00091	0.00091	0.00091
Tata tipper	0.00180	day	0.00180	0.00193	0.00180	0.00180	0.00330	0.00180
Compactor plate type	0.00330	day	0.00300	0.00393	0.00330	0.00330	0.00426	0.00330
Bitumen 80/100 trans	0.01065	MT	0.00900	0.00140	0.01065	0.01065	0.01131	0.01131
crushed rock 20mm	0.02403	cum	0.04000	0.02400	0.02403	0.024365	0.02563	0.02563
crushed rock 12.5	0.02403	cum		0.02400	0.03125	0.024365	0.02563	0.02563
Sand	0.03204	cum	0.02000	0.03199	0.03204	0.03204	0.03418	0.03418
Bitumen Spreader							0.00180	
Add inherent waste/tools					2.5%	5%	5%	
Add: Job Overhead								5%
Add for installation of camps, machinery yards, Tools				5%				
Add Water Charge				1%	1%	1%	1%	1%
Add overhead charges				15%	10%	10%	10%	5%
Add contractors profit				10%		10%	10%	10%
Total overheads			NIL	31%	13.5%	26%	26%	21%

Description AC 50mm	Quantity	Units	Quantity used by contractors						
			Package 2	Package 9	Package 1	Package 4	Package 7	Lhayul Package 5	Package
Labour	0.01671	day	0.05	0.0547800	0.02162	0.01780	0.0512	0.02162	0.01789
Road Broom	0.00007	day	0.00074	0.0000896	0.00014	0.00007	0.00009	0.00014	0.00007
Tractor with trailer	0.00007	day	0.0007	0.0000896	0.00014	0.00007	0.00009	0.00014	0.0000875
Asphalt heating kettle	0.00044	day	0.0006	0.0005632	0.00088	0.00044	0.00055	0.00088	0.00055

Bitumen sprayer	0.00045	day	0.0009	0.0005760	0.0009	0.00045	0.00059	0.00090	0.0005625
Spot mix plant	0.00158	day	0.0005	0.0024700	0.00166	0.001625	0.00126	0.00166	0.001625
Asphalt paver	0.00014	day	0.0001	0.0001792	0.00028	0.00014	0.00018	0.00028	0.000175
Road roller	0.00045	day	0.0005	0.0005760	0.0009	0.00045	0.00059	0.00090	0.0005625
Pneumatic roller	0.00045	day	0.0005	0.0005760	0.0009	0.00045	0.00059	0.00090	0.0005625
Pay loader	0.00091	day	0.0009	0.0011648	0.00182	0.00091	0.00119	0.00182	0.0011375
Tata tipper	0.00180	day	0.0018	0.0023040	0.0036	0.00180	0.00490	0.00360	0.00225
Compactor plate type	0.00330	day	0.003	0.0042240	0.0066	0.00330	0.00533	0.00660	0.004125
Bitumen 80/100	0.00821	MT	0.007	0.0014000	0.00852	0.008288	0.00663	0.00852	0.00663
crushed rock 12.5	0.02603	cum	0.035	0.0266600	0.03125	0.026038	0.0209	0.02604	0.0260375
Sand	0.02603	cum	0.023	0.0266624	0.03125	0.026038	0.0209	0.02604	0.0260375
Generator & control panel				0.00166					
crushed rock 20 mm				0.024					
Bitumen Spreader							0.00229		
Add inherent waste/tools					2.5%	5%	5%		
Add Labour cost for T & P									5%
25Add for installation of camps, machinery yards, Tools				2%					
Add Water Charge				1%	1%	1%	1%		
Add overhead charges				10%	10%	10%	10%		10%
Add contractors profit				10%		10%	10%		10%
Contingencies and Profit								45%	
Total overheads			NIL	23%	13.5%	26%	26%	45%	25%

Varying adoption of Co-efficient for labour and material by the contractors for rate analysis indicated absence of proper guidelines and procedures in the computation of co-efficient and application for labour and materials not in the LMC.

In addition, the use of varying cost component of contingencies and overheads and percentages thereof also indicated flaws and deficiencies in the LMC and Rate Analysis processes.

There needs to be uniform procedures along with standard format including percentage ceiling for contingencies and overhead applicable for rate analysis which can be consistently followed in carrying out of rate analysis.

Recommendations

The lapses and deficiencies observed in the computation and application of cost indices and rate analysis and collection of market prices and causes thereof as discussed in the preceding

paragraphs require ardent attention of the authorities concerned. It is imperative for the government to establish robust system, procedures and standards to ensure consistency and uniformity in the calculation and application of cost indices and rate analysis for obtaining value for money through realistic preparations of cost estimates of the project and valuation of additional works. Therefore, with a view to further improve the BSR and render it more relevant to provide an accurate and realistic basis of estimating cost of public works and regulating expenditure thereto and deriving value for money, the RAA offers the following recommendations:

2.1 Ministry of Works and Human Settlement should ensure mandatory and appropriate use of the published BSR in the estimation of project cost

The BSR built up item rates are based on the market prices prevailing at the base towns and allowed to be enhanced by the application of cost indices for the derivative of approximate item rate at any location. The review of the use of BSR for estimation purpose revealed that government agencies have been using past BSRs with application of cost indices even after newly updated BSR is published there by impeding realistic and reliable preparation of project cost estimates. This practice also resulted in preparation of inflated and unreliable cost estimates. The MoWHS may consider following courses of actions to ensure that most recent BSR is applied uniformly by all procuring agencies:

- Specify effective dates for implementation of revised BSR
- Make it mandatory to apply new BSR from the effective date
- Ensure that newly published BSR is easily accessible to all agencies
- Require all procuring agencies to specify that the estimates have been prepared applying the relevant BSR and provide reference thereto

2.2 BSR should either incorporate all Dzongkhags as Base Town or provide appropriate cost indices to avoid inconsistencies in the application of cost indices.

The executing government agencies have adopted varying procedures and practices in deriving the cost indices for enhancing the BSR item rates of the nearest base towns to any project locations since the BSR provide built-up item rates for Four Base Towns of Thimphu, Phuentsholing, Gelephu and S/Jongkhar.

To ensure efficient and effective preparation of project cost estimates by the executing government agencies and prevent varying and inconsistent application of cost indices, the Ministry need to come up with either built up item rates for all Dzongkhags and possible at Gewog levels or cost indices up to Dzongkhags levels.

2.3 Develop Standard Format and procedures for computing weightage percentage of particular material in terms of total cost of the project

The government agencies have either adopted varying approaches for the computation of weightage percentage of a particular material or applied the same weightage percentage of materials provided in the sample incorporated in the BSR for the calculation of cost indices. In addition, weightage percentage of materials were computed without taking into account the labour cost component thus inflating not only the cost indices but also estimation of project costs.

The Ministry should develop a standard format and procedures for computing the weightage percentage of material including clear guidelines on the application of individual material cost in terms of total cost of the project.

2.4 Develop Standard guidelines in deriving labour and materials cost at project locations as to ensure realistic calculation of cost indices

The process of deriving the item rate at any project location to be more robust to ensure transparent and objective calculation of cost indices and rate analysis.

For deriving the labour and material cost at project locations, the executing government agencies have applied various rates obtained either through annual tenders, rates of agents/dealers, quotes of contractors, average rates of suppliers/contractor in the project locations, CDCL hiring charges, NDCL supply rates including analysis of rates. Thus, varying percentage of cost indices are applied impeding cost of the project due to absence of standard procedures and guidelines in the derivative of material rates at project locations.

Ministry should review the existing procedures, processes and parameters for derivation of item rates at project locations and used for calculation of cost indices and rate analysis. Standardized procedures /guidelines should be instituted for deriving realistic and reliable labour and material cost at project locations ensuring consistencies and uniformity in working out the cost index for various locations from the base towns and avoid use of one cost index for various locations.

2.5 BSR should incorporate machinery and equipment hiring rates prevailing in the market instead of CDCL hiring charges

The Machinery and Plant hire charges incorporated in the BSR are CDCL hiring charges not based on market hiring charges prevailing at four base towns. CDCL hiring charges are adopted for rate analysis and deriving cost indices at project locations.

The consideration of CDCL hiring charges in the computation of rate analysis and calculation of cost indices tantamount to inflation of project cost as CDCL machineries and plants are not used in each and every projects executed by government agencies.

The Ministry should incorporate the machinery and plant hiring charges based on the prevailing hiring charges of all hiring agents in the base towns to build in rates and cost of machinery and plant relevant to and used in the project.

2.6 Develop Standard Format and procedures for carrying out rate analysis of item

As depicted under para 1.2 above, varying format and procedures had been adopted for carrying out rate analysis of individual item in consideration to rates at base town/ manufacturers, cost at stores, transportation charges and distances including speed of vehicles etc.

Inconsistencies in format and procedures impede computation of reliable rates for item and tantamount to inflation of cost of item and project.

Standardized procedures /guidelines should be instituted for carrying out rate analysis for consistency and uniformity and prevent deriving of unreliable rates at project locations.

2.7 Labour and Material coefficients should recognize and reflect the rapid mechanization of construction industry

Over the years, the construction industry has witnessed considerable level of mechanization with deployment of heavy machinery and equipment as well as changes in work methodologies. However, the labour and material co-efficient has remained unchanged and does not reflect the mechanization and advancement of construction industry.

Since correct application of labour and material coefficients is critical in preparing realistic and accurate cost estimates and regulating and controlling expenditure, it is necessary that the Labour and Material Coefficient reflects the extent of mechanization and technological advancements of construction industry.

The Ministry should, therefore, review the labour and materials coefficients particularly for item of works involving mechanized processes with the deployment of advanced plants, machineries and equipment to ensure reasonableness and correctness of the analyzed rates used for the estimation of the cost of constructions.

2.8 BSR should be made more comprehensive

Rates of some of the items of works have not been incorporated in the BSR, viz. DBM and AC thickness of 75mm and 50mm designed and executed in the Up-Gradation Project Northern East West Highway leading to inflated rate analysis both by the ROs and contractors.

The Bhutan Schedule of Rates (BSR) must be robust, comprehensive and reflective of all items of works required for civil and road infrastructures including market prices to provide reliable and realistic preparation of estimated cost for all Government projects. The BSR should also incorporate all aspect of expected new technologies viz. ZeoCrete technology that is being adopted for road works to prevent flawed and inflated preparation of estimates by all procuring agencies. Besides, the relevant authorities must obligate the procuring agencies to strictly ensure conformance to and application of relevant BSR in all government contracts and the estimates, cost index and rate analysis to be prepared in consultation with the Department of Engineering Services to ensure uniformity and depict appropriate cost for the locations of construction sites.

Further, the nomenclatures and unit of measurement should be categorically outlined against the items of works to prevent flaws and ambiguity in the preparation of designs, drawings, estimates, BOQs, technical specifications, decisions and implementation.

2.9 The Ministry should institute adequate and effective monitoring mechanism to render effective and cost-effective cost indices and rate analysis for project cost estimations.

Absence of monitoring controls is one of serious flaws in the enforcement of procedures and regulations in construction works executed in the public sector. The Ministry can play a critical role to ensure realistic and reliable calculation of cost indices and rate analysis by all government agencies.

Since correct application of BSR is critical in preparing realistic and accurate cost estimates and regulating and controlling expenditure, it is paramount that an adequate and effective monitoring

mechanism is instituted to check that requisite processes and procedures are strictly followed in the calculation and application of cost indices and rate analysis for estimation of project costs.

2.10 Database for prevailing prices of various brands of materials available in the market including labour at Dzongkhag levels should be maintained

One of the factors that undermine preparation of realistic cost estimations include lack of appropriate information of prices and use of erratic prices of construction materials, Machinery and plants and labour at the project locations in the calculation of cost indices and rate analysis.

The Ministry need to develop database for prevailing market prices of materials, Machinery and plant and labour at Dzongkhag levels and use of standard prices fixed for the procuring agencies to ensure reliable and cost effective calculation of cost indices and rate analysis and avoid calculation and application of varying cost indices and rate analysis within the same geographical locations.

2.11 Ministry should ensure that all government agencies and engineering personnel are adequately acquainted with the process and procedures in the calculation of cost indices and rate analysis

Government agencies including Regional Offices, DOR has adopted various procedures and practices in the calculation of weightage of material, derivative of item rate at project locations, calculation of cost indices and rate analysis. As such varying practices indicated lack of common understanding as well as consistent and uniform in the calculation of cost indices and rate analysis.

The Ministry should institute appropriate mechanism including trainings, workshops and awareness campaign for all government agencies responsible for executing government infrastructure works.

2.12 The rates of locally available materials at project locations should be ascertained and approved

The Ministry should also institute procedures and processes for working out the rates for locally available materials at project locations as to appropriately incorporate in the estimates in lieu of application of rates of the nearest base towns for material given in the BSR.

Conclusion

BSR though is expected to serve as reference only for preparing work estimates, in absence of other reliable basis, it is being widely used as an authoritative and benchmark document across all procuring agencies. It is, therefore, imperative that BSR is relevant, comprehensive and its use results in preparation of accurate and reliable cost estimates and analysis of rates and in effectively regulating payments for variations.

Despite the usefulness of BSR and the same being continually updated, the RAA observed certain inadequacies and inconsistencies in the BSR that are seriously undermining and impeding the economy, efficiency and effectiveness in executing public works. The practices currently being followed in preparing estimates, carrying out analysis of rates and regulating payments for

variations provide considerable scope for abuse of the system and inflating project estimates and cost.

The Ministry of Works and Human Settlement as the nodal Technical Authority of the Government and custodian of the Bhutan Schedule of Rates (BSR) should institute standard procedures for working out appropriate cost indices for various project locations from the base towns to depict true cost for the locations of construction sites.

The Ministry should require the procuring agencies to strictly ensure conformance to procedures for calculation of cost indices and rate analysis outlined in the BSR as to ensure consistency and uniformity in the preparation of reliable cost estimate of the projects.

The RAA has formulated series of recommendations for initiating corrective actions and addressing the flaws and deficiencies. It is advisable that government embraces a holistic and systematic approach to strengthen the calculation of cost indices and rate analysis and achieve value for money from realistic and reliable estimation of project costs.
