SSBB BOK MAP   2007 – 2015

The Certified Six Sigma Black Belt (CSSBB) body of knowledge (BOK) has been updated to ensure that the most current state of six sigma black belt practice is being tested in the examination. If you would like more information on how a BOK is updated, see a description of the process on page 4 in the Certification Handbook (PDF – 228 KB) on the www.asq.org website.

Part of the updating process is to conduct a job analysis survey to determine whether the topics in the 2007 BOK are still relevant to the job role of six sigma black belts and to identify any new topics that have emerged since that BOK was developed. The results of the SSBB job analysis survey showed that nearly all of the topics that were in the 2007 BOK are still relevant to the job roles of black belts in 2015. Three topics were removed, as indicated in the following tables. A few new topics were added to the 2015 BOK, and they are highlighted on the following pages as well.

The 2015 Certified Six Sigma Black Belt Body of Knowledge (SSBB BOK) will be introduced at the March 7, 2015, administration. Both the 2007 and the 2015 BOKs will be available online until just before that administration, at which time the 2007 BOK will be removed.

General comments about ASQ Body of Knowledge updates

When the Body of Knowledge (BOK) is updated for an ASQ exam, the majority of the material covered in the BOK remains the same. There are very few programs that change dramatically over a 5-year period. One of the points that we make to all of the exam development committees is that ASQ Certification Exams need to reflect "the state of practice" not "the state of the art" – this helps to keep the programs grounded in what people currently do, rather than being driven by the latest hot-topic improvement idea or trend. Typically, the biggest change in any updated BOK is in how the content is organized. When a new BOK is announced and posted on the ASQ website, we also include a "BOK Map" that highlights the changes between the two bodies of knowledge: old and new. The BOK map also clearly identifies any new content that has been added to the exam, as well as any content that has been removed from the exam.

The biggest change in this BOK is the rearrangement of subtopics in the first BOK Area: we combined lean and six sigma subtopics (roles & responsibilities, goals, etc.) to avoid potential overlap on each exam.

With regard to exam preparation materials, you should be able to use any of the reference books that are currently listed on the bibliography for the exam program. These are the source materials that the exam development committees use to write questions and verify answers.

2007 BOK Code	2015 BOK Details	NEW ELEMENTS in 2015 BOK
	I. Organization-wide Planning and Deployment (Questions 12)	**Increased by 3 questions**
	A. Organization-wide considerations	
I.A.1, I.A.2, I.A.3 & I.A.4	**1. Fundamentals of six sigma and lean methodologies** Define and describe the value, foundations, philosophy, history, and goals of these approaches, and describe the integration and complementary relationship between them. (Understand)	
I.A.6 & 1.B.4	**2. Six sigma, lean, and continuous improvement methodologies** Describe when to use six sigma instead of other problem-solving approaches, and describe the importance of aligning six sigma objectives with organizational goals. Describe screening criteria and how such criteria can be used for the selection of six sigma projects, lean initiatives, and other continuous improvement methods. (Apply)	
I.A.5	**3. Relationships among business systems and processes** Describe the interactive relationships among business systems, processes, and internal and external stakeholders , and the impact those **relationships** have on business systems. (Understand)	
VII.G & IX.D.1	**4. Strategic planning and deployment for initiatives** Define the importance of strategic planning for six sigma projects and lean initiatives. Demonstrate how hoshin kanri (X-matrix), portfolio analysis, and other tools can be used in support of strategic deployment of these projects. Use feasibility studies, SWOT analysis (strengths, weaknesses, opportunities, and threats), PEST analysis (political, economic, social, and technological) and contingency planning and business continuity planning to enhance strategic planning and deployment. (Apply)	
	B. Leadership	
I.B.1 & 1.B.5	**1. Roles and responsibilities** Describe the roles and responsibilities of executive leadership, champions, sponsors, process owners, master black belts, black belts, and green belts in driving six sigma and lean initiatives. Describe how each group influences project deployment in terms of providing or managing resources, enabling changes in organizational structure, and supporting communications about the purpose and deployment of the initiatives. (Understand)	
I.B.2 & I.B.3	**2. Organizational roadblocks and change management** Describe how an organization's structure and culture can impact six sigma projects. Identify common causes of six sigma failures, including lack of management support and lack of resources. Apply change management techniques, including stakeholder analysis, readiness assessments, and communication plans to overcome barriers and drive organization-wide change. (Apply)	

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	II. Organizational Process Management and Measures (10 Questions)	**Increased by 1 question**
II.A	**A. Impact on stakeholders** Describe the impact six sigma projects can have on customers, suppliers, and other stakeholders. (Understand)	
II.C	**B. Benchmarking** Define and distinguish between various types of benchmarking, e.g., best practices, competitive, collaborative, breakthrough. Select measures and performance goals for projects resulting from benchmarking activities. (Apply)	
	C. Business measures	
II.D	**1. Performance measures** Define and describe balanced scorecard, key performance indicators (KPIs), customer loyalty metrics, and leading and lagging indicators. Explain how to create a line of sight from performance measures to organizational strategies. (Analyze)	
II.E	**2. Financial measures** Define and use revenue growth, market share, margin, net present value (NPV), return on investment (ROI), and cost-benefit analysis (CBA). Explain the difference between hard cost measures (from profit and loss statements) and soft cost benefits of cost avoidance and reduction. (Apply)	
	III. Team Management (18 Questions)	**Increased by 2 questions**
	A. Team formation	
III.A.1	**1. Team types and constraints** Define and describe various teams, including virtual, cross-functional, and self-directed. Determine what team type will work best for a given a set of constraints, e.g., geography, technology availability, staff schedules, time zones. (Apply)	
III.A.2	**2. Team roles and responsibilities** Define and describe various team roles and responsibilities for leader, facilitator, coach, and individual member. (Understand)	
III.A.3	**3. Team member selection criteria** Describe various factors that influence the selection of team members, including the ability to influence, openness to change, required skills sets, subject matter expertise, and availability. (Apply)	
III.A.4	**4. Team success factors** Identify and describe the elements necessary for successful teams, e.g., management support, clear goals, ground rules, timelines. (Apply)	Changed title only [from 'Launching teams']

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	B. Team facilitation	
III.B.1	**1. Motivational techniques** Describe and apply techniques to motivate team members. Identify factors that can demotivate team members and describe techniques to overcome them. (Apply)	
III.B.2	**2. Team stages of development** Identify and describe the classic stages of team development: forming, storming, norming, performing, and adjourning. (Apply)	
III.B.3	**3. Team communication** Describe and explain the elements of an effective communication plan, e.g., audience identification, message type, medium, frequency. (Apply)	
NEW	**4. Team leadership models** Describe and select appropriate leadership approaches (e.g., direct, coach, support, delegate) to ensure team success. (Apply)	Entirely new content
	C. Team dynamics	
III.C	**1. Group behaviors** Identify and use various conflict resolution techniques (e.g., coaching, mentoring, intervention) to overcome negative group dynamics, including dominant and reluctant participants, groupthink, rushing to finish, and digressions. (Evaluate)	Changed title only [from 'Team dynamics']
III.D	**2. Meeting management** Select and use various meeting management techniques, including using agendas, starting on time, requiring pre-work by attendees, and ensuring that the right people and resources are available. (Apply)	Changed title only [from 'Time mgmt for teams']
III.E	**3. Team decision-making methods** Define, select, and use various tools (e.g., consensus, nominal group technique, multi-voting) for decision-making. (Apply)	
	D. Team training	
NEW	**1. Needs assessment** Identify the steps involved to implement an effective training curriculum: identify skills gaps, develop learning objectives, prepare a training plan, and develop training materials. (Understand)	Entirely new content
NEW	**2. Delivery** Describe various techniques used to deliver effective training, including adult learning theory, soft skills, and modes of learning. (Understand)	Entirely new content
III.G	**3. Evaluation** Describe various techniques to evaluate training, including evaluation planning, feedback surveys, pre-training	

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	and post-training testing. (Understand)	
IV. Define (20 Questions)		**Increased by 5 questions**
	A. Voice of the customer	
IV.A.1	**1. Customer identification** Identify and segment customers and show how a project will impact both internal and external customers. (Apply)	
IV.A.2	**2. Customer data collection** Identify and select appropriate data collection methods (e.g., surveys, focus groups, interviews, observations) to gather voice of the customer data. Ensure the data collection methods used are reviewed for validity and reliability. (Analyze)	
II.B IV.A.3 V.A.1	**3. Customer requirements** Define, select, and apply appropriate tools to determine customer needs and requirements, including critical-to-X (CTX when 'X' can be quality, cost, safety, etc.), CTQ tree, quality function deployment (QFD), supplier, input, process, output, customer (SIPOC) and Kano model. (Analyze)	
	B. Business case and project charter	
NEW	**1. Business case** Describe business case justification used to support projects. (Understand)	Entirely new content
IV.B.1	**2. Problem statement** Develop a project problem statement and evaluate it in relation to baseline performance and improvement goals. (Evaluate)	
IV.B.2	**3. Project scope** Develop and review project boundaries to ensure that the project has value to the customer. (Analyze)	
IV.B.3	**4. Goals and objectives** Identify SMART (specific, measureable, actionable, relevant and time bound) goals and objectives on the basis of the project's problem statement and scope. (Analyze)	Added 'SMART'
IV.B.4	**5. Project performance measurements** Identify and evaluate performance measurements (e.g., cost, revenue, delivery, schedule, customer satisfaction) that connect critical elements of the process to key outputs. (Analyze)	
	6. Project charter review Explain the importance of having periodic project charter reviews with stakeholders. (Understand)	

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	C. Project management (PM) tools Identify and use the following PM tools to track projects and document their progress. (Evaluate)	Changed title ['Project tracking'], created subtopics
IV.C	**1.** Gantt charts	
IV.C.	**2.** Toll-gate reviews	
NEW	**3.** Work breakdown structure (WBS)	Entirely new content
NEW	**4.** RACI model (responsible, accountable, consulted and informed)	Entirely new content
III.F.	**D. Analytical tools** Identify and use the following analytical tools throughout the DMAIC cycle. (Apply)	Changed title 'Management & planning tools' and created subtopics
	1. Affinity diagrams	
	2. Tree diagrams	
	3. Matrix diagrams	
	4. Prioritization matrices	
	5. Activity network diagrams	
III.F	Process decision program charts (PDPC) and interrelationship digraphs have been deleted from the BOK	/////////////
	V. Measure (25 Questions)	**Decreased by 1 question**
	A. Process characteristics	
V.A.2	**1. Process flow metrics** Identify and use process flow metrics (e.g., work in progress (WIP), work in queue (WIQ), touch time, takt time, cycle time, throughput) to determine constraints. Describe the impact that "hidden factories" can have on process flow metrics. (Analyze)	
V.A.3	**2. Process analysis tools** Select, use and evaluate various tools, e.g., value stream maps, process maps, work instructions, flowcharts, spaghetti diagrams, circle diagrams, gemba walk. (Evaluate)	
	B. Data collection	
V.B.1 V.C.1	**1. Types of data** Define, classify, and distinguish between qualitative and quantitative data, and continuous and discrete data. (Evaluate)	
V.B.2	**2. Measurement scales**	

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	Define and use nominal, ordinal, interval, and ratio measurement scales. (Apply)	
V.B.3	**3. Sampling** Define and describe sampling concepts, including representative selection, homogeneity, bias, accuracy, and precision. Determine the appropriate sampling method (e.g., random, stratified, systematic, subgroup, block) to obtain valid representation in various situations. (Evaluate)	
V.B.4	**4. Data collection plans and methods** Develop and implement data collection plans that include data capture and processing tools, e.g., check sheets, data coding, data cleaning (imputation techniques). Avoid data collection pitfalls by defining the metrics to be used or collected, ensuring that collectors are trained in the tools and understand how the data will be used, and checking for seasonality effects. (Analyze)	
	C. Measurement systems	
V.C.2	1. **Measurement system analysis (MSA)** Use gauge repeatability and reproducibility (R&R) studies and other MSA tools (e.g., bias, correlation, linearity, precision to tolerance, percent agreement) to analyze measurement system capability. (Evaluate)	
V.C.3	2. **Measurement systems across the organization** Identify how measurement systems can be applied to marketing, sales, engineering, research and development (R&D), supply chain management, and customer satisfaction data. (Understand)	
V.C.4	3. **Metrology** Define and describe elements of metrology, including calibration systems, traceability to reference standards, and the control and integrity of measurement devices and standards. (Understand)	
	D. Basic statistics	
V.D.1	1. **Basic statistical terms** Define and distinguish between population parameters and sample statistics, e.g., proportion, mean, standard deviation. (Apply)	
V.D.2	2. **Central limit theorem** Explain the central limit theorem and its significance in the application of inferential statistics for confidence intervals, hypothesis tests, and control charts. (Understand)	
V.D.3	3. **Descriptive statistics** Calculate and interpret measures of dispersion and central tendency. (Evaluate)	
V.D.4	4. **Graphical methods** Construct and interpret diagrams and charts, e.g., box-and-whisker plots, scatter diagrams, histograms, normal probability plots, frequency distributions, cumulative frequency distributions. (Evaluate)	

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V.D.5	**5. Valid statistical conclusions** Distinguish between descriptive and inferential statistical studies. Evaluate how the results of statistical studies are used to draw valid conclusions. (Evaluate)	
	E. Probability	
V.E.1	**1. Basic concepts** Describe and apply probability concepts, e.g., independence, mutually exclusive events, addition and multiplication rules, conditional probability, complementary probability, joint occurrence of events. (Apply)	
V.E.2 V.E.3	**2. Distributions** Describe, interpret, and use various distributions, e.g., normal, Poisson, binomial, chi square, Student's t, F, hypergeometric, bivariate, exponential, lognormal, Weibull. (Evaluate)	
	F. Process capability	
V.F.1	**1. Process capability indices** Define, select, and calculate C_p and C_{pk}. (Evaluate)	
V.F.2	**2. Process performance indices** Define, select, and calculate P_p, P_{pk}, C_{pm}, and process sigma. (Evaluate)	
V.F.6	**3. General process capability studies** Describe and apply elements of designing and conducting process capability studies relative to characteristics, specifications, sampling plans, stability and normality. (Evaluate)	
V.F.5	**4. Process capability for attributes data** Calculate the process capability and process sigma level for attributes data. (Apply)	
V.F.4	**5. Process capability for non-normal data** Identify non-normal data and determine when it is appropriate to use Box-Cox or other transformation techniques. (Apply)	
V.F.7	**6. Process performance vs. specification** Distinguish between natural process limits and specification limits. Calculate process performance metrics, e.g., percent defective, parts per million (PPM), defects per million opportunities (DPMO), defects per unit (DPU), throughput yield, rolled throughput yield (RTY). (Evaluate)	
V.F.3	**7. Short-term and long-term capability** Describe and use appropriate assumptions and conventions when only short-term data or only long-term data are available. Interpret the relationship between short-term and long-term capability. (Evaluate)	

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	VI. Analyze (22 Questions)	**Decreased by 2 questions**
	A. Measuring and modeling relationships between variables	
VI.A.1	**1. Correlation coefficient** Calculate and interpret the correlation coefficient and its confidence interval, and describe the difference between correlation and causation. (Evaluate)	
VI.A.2	**2. Linear regression** Calculate and interpret regression analysis, and apply and interpret hypothesis tests for regression statistics. Use the regression model for estimation and prediction, analyze the uncertainty in the estimate, and perform a residuals analysis to validate the model. (Evaluate)	
VI.A.3	**3. Multivariate tools** Use and interpret multivariate tools (e.g., factor analysis, discriminant analysis, multiple analysis of variance (MANOVA)) to investigate sources of variation. (Evaluate)	Principal components analysis (PCA) was removed from this subtopic
VI.A.4	"Multi-vari studies" has been deleted entirely from the SSBB BOK	
VI.A.5	"Attributes data analysis" has been deleted entirely from the SSBB BOK	
	B. Hypothesis testing	
VI.B.1	**1. Terminology** Define and interpret the significance level, power, type I, and type II errors of statistical tests. (Evaluate)	
VI.B.2	**2. Statistical vs. practical significance** Define, compare, and interpret statistical and practical significance. (Evaluate)	
VI.B.3	**3. Sample size** Calculate sample size for common hypothesis tests: equality of means and equality of proportions. (Apply)	
VI.B.4	**4. Point and interval estimates** Define and distinguish between confidence and prediction intervals. Define and interpret the efficiency and bias of estimators. Calculate tolerance and confidence intervals. (Evaluate)	
VI.B.5	**5. Tests for means, variances, and proportions** Use and interpret the results of hypothesis tests for means, variances, and proportions. (Evaluate)	
VI.B.6	**6. Analysis of variance (ANOVA)** Select, calculate, and interpret the results of ANOVAs. (Evaluate)	

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VI.B.7	**7. Goodness-of-fit (chi square) tests** Define, select, and interpret the results of these tests. (Evaluate)	
VI.B.8	**8. Contingency tables** Select, develop, and use contingency tables to determine statistical significance. (Evaluate)	
VI.B.9	**9. Non-parametric tests** Understand the importance of the Kruskal-Wallis and Mann-Whitney tests and when they should be used. (Understand)	Subtext modified: deleted Mood's median & Levene's test
VI.C	**C. Failure mode and effects analysis (FMEA)** Describe the purpose and elements of FMEA, including risk priority number (RPN), and evaluate FMEA results for processes, products, and services. Distinguish between design FMEA (DFMEA) and process FMEA (PFMEA), and interpret their results. (Evaluate)	
	D. Additional analysis methods	
VI.D.1	**1. Gap analysis** Analyze scenarios to identify performance gaps, and compare current and future states using predefined metrics. (Analyze)	
VI.D.2	**2. Root cause analysis** Define and describe the purpose of root cause analysis, recognize the issues involved in identifying a root cause, and use various tools (e.g., 5 whys, Pareto charts, fault tree analysis, cause and effect diagrams) to resolve chronic problems. (Analyze)	
VI.D.3	**3. Waste analysis** Identify and interpret the seven classic wastes (overproduction, inventory, defects, over-processing, waiting, motion, transportation) and resource under-utilization. (Analyze)	
	VII. Improve (21 Questions)	**Decreased by 2 questions**
	A. Design of experiments (DOE)	
VII.A.1	**1. Terminology** Define basic DOE terms, e.g., independent and dependent variables, factors and levels, response, treatment, error, nested. (Understand)	
VII.A.2	**2. Design principles** Define and apply DOE principles, e.g., power, sample size, balance, repetition, replication, order, efficiency, randomization, blocking, interaction, confounding, resolution. (Apply)	

2007 BOK Code	2015 BOK Details	NEW ELEMENTS in 2015 BOK
VII.A.3	**3. Planning experiments** Plan and evaluate DOEs by determining the objective, selecting appropriate factors, responses, and measurement methods, and choosing the appropriate design. (Evaluate)	
VII.A.4	**4. One-factor experiments** Design and conduct completely randomized, randomized block, and Latin square designs, and evaluate their results. (Evaluate)	
VII.A.5	**5. Two-level fractional factorial experiments** Design, analyze, and interpret these types of experiments, and describe how confounding can affect their use. (Evaluate)	
VII.A.6	**6. Full factorial experiments** Design, conduct, and analyze these types of experiments. (Evaluate)	
	B. Lean methods	
VII.B	**1. Waste elimination** Select and apply tools and techniques for eliminating or preventing waste, e.g., pull systems, kanban, 5S, standard work, poka-yoke. (Analyze)	
VII.C	**2. Cycle-time reduction** Use various tools and techniques for reducing cycle time, e.g., continuous flow, single-minute exchange of die (SMED), heijunka (production leveling). (Analyze)	
VII.D	**3. Kaizen** Define and distinguish between kaizen and kaizen blitz and describe when to use each method. (Apply)	
VII.E	**4. Other improvement tools and techniques** Identify and describe how other process improvement methodologies are used, e.g., theory of constraints (TOC), overall equipment effectiveness (OEE). (Understand)	
VII.F	**C. Implementation** Develop plans for implementing proposed improvements, including conducting pilot tests or simulations, and evaluate results to select the optimum solution. (Evaluate)	
	VIII. Control (15 Questions)	**Decreased by 6 questions**
	A. Statistical process control (SPC)	
VIII.A.1	**1. Objectives** Explain the objectives of SPC, including monitoring and controlling process performance, tracking trends, runs, and reducing variation within a process. (Understand)	

2007 BOK Code	2015 BOK Details	NEW ELEMENTS in 2015 BOK
VIII.A.2	**2. Selection of variables** Identify and select critical process characteristics for control chart monitoring. (Apply)	
VIII.A.3	**3. Rational subgrouping** Define and apply the principle of rational subgrouping. (Apply)	
VIII.A.4	**4. Control chart selection** Select and use control charts in various situations: $\overline{X} - R$, $\overline{X} - s$, individual and moving range (ImR), p, np, c, u, short-run SPC, and moving average. (Apply)	
VIII.A.5	**5. Control chart analysis** Interpret control charts and distinguish between common and special causes using rules for determining statistical control. (Analyze)	
	B. Other controls	
VIII.B.1	**1. Total productive maintenance (TPM)** Define the elements of TPM and describe how it can be used to consistently control the improved process. (Understand)	
VIII.B.2	**2. Visual controls** Define the elements of visual controls (e.g., pictures of correct procedures, color-coded components, indicator lights), and describe how they can help control the improved process. (Understand)	Changed title 'visual factory' & expanded subtext
	C. Maintain controls	
VIII.C.1	**1. Measurement system reanalysis** Review and evaluate measurement system capability as process capability improves, and ensure that measurement capability is sufficient for its intended use. (Evaluate)	
VIII.C.2	**2. Control plan** Develop a control plan to maintain the improved process performance, enable continuous improvement, and transfer responsibility from the project team to the process owner. (Apply)	
	D. Sustain improvements	
VIII.D.1	**1. Lessons learned** Document the lessons learned from all phases of a project and identify how improvements can be replicated and applied to other processes in the organization. (Apply)	
VIII.D.3	**2. Documentation** Develop or modify documents including standard operating procedures (SOPs), work instructions, and control plans to ensure that the improvements are sustained over time. (Apply)	

2007 BOK Code	2015 BOK Details	NEW ELEMENTS in 2015 BOK
VIII.D.2	**3. Training for process owners and staff** Develop and implement training plans to ensure consistent execution of revised process methods and standards to maintain process improvements. (Apply)	
VIII.D.4	**4. Ongoing evaluation** Identify and apply tools (e.g., control charts, control plans) for ongoing evaluation of the improved process, including monitoring leading indicators, lagging indicators, and additional opportunities for improvement. (Apply)	
	IX. Design for Six Sigma (DFSS) (7 Questions)	**Same # of questions**
IX.A.1 IX.A.2	**A. Common DFSS methodologies** Identify and describe DMADV (define, measure, analyze, design, and validate) and DMADOV (define, measure, analyze, design, optimize, and validate). (Understand)	
IX.B	**B. Design for X (DFX)** Describe design constraints, including design for cost, design for manufacturability (producibility), design for test, and design for maintainability. (Understand)	
IX.C	**C. Robust designs** Describe the elements of robust product design, tolerance design, and statistical tolerancing. (Understand)	
IX.D.1 & 2	Special design tools (1. Strategic & 2. Tactical) have been deleted entirely from the SSBB BOK.	