

British Columbia Construction Association

Integrating Newcomers

A comparison of select British Columbian and German apprenticeships

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Preface

We conducted a comparison of apprenticeship essential, health and safety, and legislated skills requirements, training contents, and certification processes between British Columbia and the Federal Republic of Germany (*Bundesrepublik Deutschland*) for 5 trades: Carpenter, Construction Electrician, Construction Craft Worker, Plumber, and Roofer.

The goal of the comparison is to provide a reasoned tool for newcomers - and their advisors - when they are trying to determine what BC trade best matches their trade credential and experience.

The report is in 4 parts:

1. A quick summary equivalency reference tool with upgrade recommendations
2. A methodology section outlining how we arrived at the conclusions
3. A results section containing full details of the analysis undergirding the reference tool
4. A discussion section that addresses briefly what the results might mean and how these considerations might be used for make-up training and the job-aids.

The first section (“An applied glimpse at differences”) can be used as a stand-alone. Newcomers and their advisors will find all the key comparisons and upgrade recommendations there. The section is the summary of the other three sections which, together, provide a level of detail more appropriate to policy-driven endeavors.

Due to scope constraints, we have focussed the comparisons using the BC apprenticeship program and BC legislated requirements as bases for technical, safety, and compliance skills. But we used Employment and Social Development Canada’s Essential Skills profiles for our analysis of literacy and numeracy skills requirements.

An applied glimpse at differences

In this summary tool, we outline trade credential equivalency processes and “high-level” comparisons of the skills, programs, and certification mechanisms for the 5 trades. Three sections follow the executive summary: methodology, results, and discussion. The methodology section lists the data sources we used and how we conducted the analysis. The results section makes thorough use of tables and color-coding to provide fine-grained analysis and summative results. And the discussion section contains practical, reasoned recommendations.

Credential equivalency

There is no formal recognition of trade credentials in Canada; there is no assured exchange of a foreign trade credential for an equivalent Canadian credential.

In British Columbia (BC), no credential is required to work in any of the trades. Some specific trade activities, however, require a relevant base trade credential – for example to “pull” electrical permits or connect a gas furnace. Mandatory credential requirements vary from Canadian jurisdiction to jurisdiction; consult the provincial Apprenticeship website or the Federal Ellis Chart¹.

Trade credentials in BC are awarded by the Industry Training Authority (ITA). Similar entities – provincial government departments or crown-enabled institutions – award trade credentials in the other Canadian provinces and territories.

In BC², the ITA issues 2 trade credentials: the Certificate of Apprenticeship (CofA) and the Certificate of Qualification (CofQ). These credentials bear the federal Red Seal endorsement for Red Seal trades³. CofA credentials are issued upon successful completion of the relevant apprenticeship program. CofQ credentials are issued upon successful completion of the relevant Red Seal or Interprovincial Standards examination (IP). CofQs without Red Seal endorsement are awarded for non-Red Seal trades upon successful completion of the relevant ITA CofQ examination.

Access to these examinations is by one of two routes: apprenticeship program completion or challenge based on time-in-trade. Apprenticeship programs vary in length and in the number of weeks of in-school training over the duration of the program – apprentices are registered with the ITA; in-school training is through ITA-approved public and private training providers. Time-in-trade challengers are required to prove they have practiced the trade for at least 1.5 times the stipulated length of the apprenticeship on-the-job hours (See Table below).

Table 1. Trade certification requirements in BC

Trade	Apprenticeship		Challenge	
	In-school (weeks)	On-the-job (hours)	On-the-job (hours)	Fee
Carpenter	28	6480	9720	C\$120
Construction Electrician	40	6000	9000	C\$120
Construction Craft Worker	8	4000	6000	C\$120
Plumber	32	6420	9630	C\$120
Roofer	12	3600	5400	C\$120

¹ <http://www.ellischart.ca/search/s.2.1rch-eng.html> last accessed 29 September 2016

² The same general process holds in the other Canadian jurisdictions.

³ <http://www.itabc.ca/discover-apprenticeship-programs/search-programs> accessed 23 September 2016

Essential skills equivalency

In all of the 5 trades, workers are expected to read, consult, and fill a range of documents, from simple forms requiring dates, times, or measurements to detailed reports to engineers, inspectors, or customers. The “Germany – All trades” scores reflect our assumption that newcomers who have had basic English language training have the skills to handle simple documents – these often provide or require numerical information such as readings or measurements. We also assumed that newcomers would be able to understand simple instructions (written or spoken) but would not have the technical language skills required to write complex reports, direct small teams, or take an active part in group discussions such as pre-job conferences or tailboards.

Table 2. Summative select Essential Skills complexity scores (Carp. means Carpenter; C.E. means Construction Electrician; C.C.W. means Construction Craft Worker; Plumb. means Plumber; Roof. means Roofer)

Essential Skills' Category	Trade					Germany
	Carp.	C.E.	C.C.W.	Plumb.	Roof.	All trades
Reading	2.56	2.11	1.67	2.44	1.67	0.33
Document use	1.89	2.78	1.11	1.89	1.67	0.89
Writing	1.60	1.60	1.20	1.20	0.40	0.00
Numeracy	1.64	1.71	1.14	2.00	1.71	0.86
Oral Communication	1.50	1.90	0.80	1.00	1.50	0.50

Health and Safety, and other legislated skills equivalencies

The “skills” listed in the table below are, at a minimum, those that trade persons are expected to have when reporting to the job site. Doubtless similar types of skills are required in Germany, but since most of these are highly jurisdiction-specific, newcomers would not have equivalent skills.

In some cases, it is the employer’s responsibility to provide training or equipment, but that is not always the case. Trade persons should make sure they have the skills and qualifications required to work safely and within the legislated framework for their trade’s most common demands.

Trade persons are often expected to drive a company vehicle – most likely a pick-up truck or van. These vehicles can be operated with a Class 5 BC Driver’s License. ICBC has an agreement in place to exchange a German driver’s license for a BC one (some conditions apply).

Table 3. Select Regulatory Requirements scores (using same complexity scores as for Essential Skills)

Regulatory requirements	Trade				
	Carp.	C.E.	C.C.W.	Plumb.	Roof.
OSH Requirements					
WorkSafeBC (WSBC) Rights and Responsibilities	0	0	0	0	0
WSBC Young / New Worker (Training & Orientation)	0	0	0	0	0
Personal Protective Equipment (PPE) requirements	0	0	0	0	0
Duty to co-operate with internal and external OSH officials	0	0	0	0	0
Other Regulatory Requirements					

Regulatory requirements	Trade				
	Carp.	C.E.	C.C.W.	Plumb.	Roof.
WHMIS	0	0	0	0	0
Fall arrest / restraint / protection	1	1	1	N/A	1
Confined space	N/A	1	N/A	1	N/A
Building Code	0	N/A	0	0	0
Gas Code (B 149.1)	N/A	N/A	N/A	0	N/A
Canadian Electrical Code	N/A	0	N/A	0	N/A
Driver's License (Class 5)	5	5	5	5	5

Training contents equivalency

Major differences all trades

Table 4. Major differences between the BC and German apprenticeship programs for 5 trades, by trade.

Trade	Major differences
Carpenter	<ul style="list-style-type: none"> The German program includes timber framing not covered in BC. The German program includes Quality Assurance competencies. The BC program includes some rigging and hoisting, excavation, concrete placement, formwork, aerial lift, and oxy-fuel components not listed in German program. German building codes are different. The BC program has 4 levels of block release in-school training over 4 years; the German has 1-2 days day-release in-school training over 3 years.
Construction Craft Worker	<ul style="list-style-type: none"> The trade/occupation as such is not recognized in Germany; the apprentices specialize in one of masonry, concrete work, or furnace and chimney construction based on job. We used the concrete specialization for the analysis. The BC program has 2 levels of block-release in-school training over 2 years; the German has 1-2 days day-release in-school training over 2 years.
Construction Electrician	<ul style="list-style-type: none"> The BC program includes nurse call and high voltage components. The German program does not emphasize electrical theory but includes advanced troubleshooting and equipment building components. The German codes and common voltages are different than those in BC. The BC program has 4 levels of block-release in-school training over 4 years; the German has 1-2 days day-release in-school training over 3 years.
Plumber	<ul style="list-style-type: none"> The BC program includes sprinkler and GAS B components not present in the German program. The BC program has well and septic systems components not mentioned in the German program. The German program has solid-fuel furnace and high and low pressure boiler components not present in the BC program. The BC program has 4 levels of block release in-school training; the German has 1-2 days day-release in-school training over 3.5 years.
Roofer	<ul style="list-style-type: none"> German roofers do not routinely install wood shingles and shakes. The BC and German programs have similar Occupational Profiles and in-school training. Both the BC program and German programs have 3 levels of block release in-school training.

Most important trade areas equivalencies

The table below contains a rated summary of the 5 most important trade areas for each trade, where importance is based on in-school and on-the-job training effort expressed in percentage of the apprenticeship duration.

Table 5. Top 5 trade areas for all trades (ratings; 0=not mentioned; 1=some overlap with BC program; 2=substantial overlap with BC program)

Top 5 General Areas of Competence by trade				
Trade and GACs	BC program			Germany
	School	On-job	Total %	Dual stream
	Hours	Hours		Rating
Carpenter (Zimmerer/Zimmerin)				
Wood Frame Construction	191.1	1474	23%	1
Concrete Formwork	161.7	1247	19%	0
Documentation and Organizational Skills	157.5	1215	19%	1
Finishing Materials	96.6	745.2	12%	1
Tools and Equipment	67.2	518.4	8%	2
Construction Electrician (Bauelektriker/in)				
Apply Circuit Concepts	441	2205	37%	1
Install Electrical Equipment	210	1050	18%	2
Install Low Voltage Distribution Systems	168	840	14%	2
Install Control Circuits and Devices	168	840	14%	2
Read and Interpret Drawings and Manuals	75	375	6%	1
Plumber (Anlagenmechaniker/in)				
Install Natural Gas and Propane Systems	192	1580	25%	0
Organize Work	122.5	1009	16%	2
Install Sanitary and Storm Drainage Systems	113.8	936.3	15%	2
Install Water Service and Distribution	96	790.1	12%	2
Install Hydronic Heating and Cooling	77.04	634.1	10%	1
Construction Craft Worker (Hochbaufacharbeiter/in – Schwerpunkt Beton- und Stahlbetonarbeiten)				
Perform Concrete Work	45.6	19%	760	2
Perform Site Work	43.2	18%	720	2
Use Scaffolding and Access Equipment	27.6	12%	460	2
Perform Utilities and Pipeline Tasks	26.4	11%	440	0
Organize Work	24	10%	400	2

Top 5 General Areas of Competence by trade				
Trade and GACs	BC program			Germany
	School	On-job	Total %	Dual stream
	Hours	Hours		Rating
Roofer (Damp- and Waterproofer) (<i>Dachdecker/in - Fachrichtung Dach-, Wand- und Abdichtungstechnik</i>)				
Install Low Slope and Flat Roofing	138.0	1380	38%	2
Install Steep Roofing	55.2	552	15%	2
Organize Work	45.6	456	13%	2
Use Safe Work Practices	44.4	444	12%	1
Use Documentation	32.4	324	9%	2

Certification process equivalency

Apprentices are required to pass each of 2-4 levels (blocks) of in-school training. While under review, practical and theory tests were institution-specific, but coordinated through a BC Articulation Committee for some of the trades. Successful completion of the final Level in-school final exam gives access to the Red Seal examination, the only certification mechanism for trade persons in BC (all of the trades we looked at are “Red Seal” trades).

This is less comprehensive and holistic than the German credentialing system - based on test theory, the German credential is the more robust of the two. And the rigor of the process should, given the lack of “compulsory” trades in BC, allow a credentialed German trade worker to be taken as qualified as a BC one - after having addressed the skills gaps as indicated in “Recommendations” below.

The table below summarizes the major differences.

Table 6. Comparison of BC and Germany examination and credentialing

Examination and certification		
Element	BC	Germany
Exam	Single	Multiple
	Pencil & paper	Pencil & paper
		Hands-on
Domains tested	Multiple unspecified	Multiple specified
	Proxy	Direct
Domain inclusion	Negotiated norm	Criterion
Item type	Selected response	Constructed response
Scoring	Machine	Rubric-based
		Examiner teams
Scores	One correct	Graded
Results	Unique fixed cut score	Compounded
Validity	Medium	Strong
Reliability	Unknown	Strong
Credential	Endorsement	National

Recommendations

Essential Skills recommendations

Clearly, English language skills are the major stumbling block to a German trade person recently arrived in BC. But offering generic English Second Language (ESL), while useful for integration into the larger community, will not help on the job site.

For that, a two-part educational component made up of (i) trade and legalistic English and (ii) worksite protocols and business processes - making use of documents, such as trade regulations or codes pertinent to the newcomers' trade. The job aid would be a pocket or app-based trade dictionary (containing the most common terms and expressions aligned to the BC apprentice trade manual(s)).

Health and Safety, and other legislated skills recommendations

There are a number of online training opportunities for all of the OSH requirements that are appropriate and recognized. These can be purchased for approximately \$200.

Code books (or relevant appropriate section) can be purchased for \$150-250 online or at specialized bookstores – knowing the code will be important for those workers wanting to challenge the Red Seal examination, especially for Plumbers and Electricians.

Plumbers wishing to install and connect gas-fired appliances will have to take a course and pass the relevant Safety Authority examination.

Carpenter recommendations

Providing German carpenters with the in-school equivalent of H line in Level 1 (approximately 2 weeks) and G Line in Level 2 (approximately 4 weeks) of the apprenticeship program would bring them up to speed.

Alternatively, they could pick up these skills on the job if they were employed as a Construction Craft Worker, whether as an apprentice or a laborer, getting to Red Seal certification in 2-3 years.

Construction Electrician recommendations

German electricians have the skills to be productive on a worksite. But they will need to adapt to base voltage differences between Europe and Canada. Likewise, codes and regulations driving work practices will be foreign to them. Providing them with the in-school equivalent of K line in Level 4 (approximately 1 week) of the apprenticeship program and an Electrical Code course (approximately 2 weeks a day/week and \$600) would bring them up to speed.

Alternatively, they could pick up these skills on the job, getting to Red Seal certification in a year or so.

Plumber recommendations

German plumbers have the skills to be productive on a worksite. But codes and regulations driving work practices will be foreign to them. Providing them with the in-school equivalent of C3 in C line in Level 1 (approximately 1 week) of the apprenticeship program and a Gas B course (approximately 3 weeks and \$1000) would bring them up to speed.

Alternatively, they could pick up code-related skills on the job and take the Gas B course – in order to get the Safety Authority qualification, then challenge the Red Seal examination.

Construction Craft Worker recommendations

German Building Construction Workers – concrete have the skills to be productive on a worksite. But, codes and regulations driving work practices will be foreign to them. Once over the language barrier (if any) they could pick up code-related, roadwork, piping, and masonry skills on the job and then challenge the Red Seal examination.

Roofer recommendations

German Roofers have the skills to be productive on a worksite, be it flat, low slope, or steep roofing. But, codes, regulations, and industry standards driving work practices will be foreign to them. Once over the language barrier (if any) they could pick up wood shingling skills on the job and then challenge the Red Seal examination.

Methodology

We obtained data from 3 major German sources of information, and one main source for British Columbia. The German sources were:

- Federal Institute for Vocational Education and Training (*Bundesinstitut für Berufsbildung – BIBB*⁴)
- The Online Career Service (*Berufenet Arbeitsagentur*⁵)
- German Qualification Framework (*Deutscher Qualifikationrahmen - DQR*⁶)

Which were concerned (among other things) with providing access to employment through continuing education and training.

On these sites we collected data from the following documents or web pages:

- [bibb_vet_data_report_2015_barrierefrei](#)
- https://www.bibb.de/en/occupationsinfo.php/certificate_supplements/en (for each trade)
- <https://berufenet.arbeitsagentur.de/berufenet/faces/index?path=null/sucheAZ/kurzbeschreibung/berufkompetenzen&dkz=4010&let=Z> (for each trade)

The British Columbian sources were:

- ITA (Industry Training Authority).
- WorkSafeBC⁷
- ICBC⁸

On these sites we collected data from the following documents or web pages:

- ITA Program Profile
- ITA Program Outline
- WorkSafeBC Employee Roles, Rights and Responsibilities web pages
- WorkSafeBC Young or New Workers Training Guide pdf
- ICBC “Moving to BC” web pages

In the report we use the BC trade name, requisites, and content as the reference.

Essential skills

Employment and Social Development Canada (ESDC)⁹ has published essential skills profiles for over 350 occupations. Essential skills fall under a number of categories. To make things simpler, we have retained those shown in Table 7 below. We did not retain the “Thinking”, “Digital Technology”, “Working with Others”, or “Continuous Learning” as these categories address either the newcomer or her culture or his opportunities rather than portable skills amenable to improvement through training.

As a reference, we used the Essential Skills profile for Construction Trades Helpers and Labourers (NOC 7611, 7612) assuming it was similar to the BC Construction Craft Worker (C.C.W.) trade. And we aligned the Essential Skills for the other 4 trades to those for C.C.W. retaining the complexity score as

⁴ <https://www.bibb.de/en/> last accessed 28 September 2016

⁵ <https://berufenet.arbeitsagentur.de/> Last accessed 28 September 2016

⁶ <http://www.dqr.de/> last accessed 3 October 2016

⁷ <https://www.worksafebc.com/en> last accessed 2 October 2016

⁸ <http://www.icbc.com/driver-licensing/moving-bc/Pages/default.aspx> last accessed 2 October 2016

⁹ http://www.esdc.gc.ca/en/essential_skills/profiles/index.page accessed 20 September 2016

published. Skills in each of the categories are accompanied by a “complexity rating” ranging from 1-5, where “1” means “basic” and “5” means “advanced”.

We married the Common European Framework of Reference for Languages: Learning, Teaching, Assessment (CEFR)¹⁰ to the Canadian complexity rating in order to assign a complexity score to an average German tradesperson, i.e., a non-native speaker of English who might have had some basic training in English.

To assign complexity scores, we stipulated that the CEFR language proficiency were arranged on this continuum: reception (listening and reading – A1/A2) < production (spoken and written – B1) < interaction (spoken and written – B2) < mediation (translating and interpreting – C1/C2). We have assumed that these ratings are interval-based in order to calculate averages. We used 0 to indicate absence.

In effect, we boosted the complexity scale from an ordinal to and interval scale in order to legitimately calculate average scores. We used Bond and Fox, 2007¹¹ scale explanation as a rationale:

- Nominal scales– separate the data of interest in defined, recognizable classes, for example, there is an “A”, a “B”, a “C”, ... a “n”
- Ordinal scales – separate nominal data along a quantitative axis, for example A>B>C>...n, therefore, e.g. A>n
- Interval scales – separate ordinal data along a regular quantitative axis, for example A>B>C>...n, such that (A-z)=B, (B-z)=C, (C-z)=D, ..., (m-z)=n, and z is invariant or constant but specific to the data (and scale) at hand (e.g. millimeters, cents, seconds, etc.)
- Ratio scales – separate interval data along a quantitative axis, for example A>B>C>...n, such that (A-z)=B, (B-z)=C, (C-z)=D, ..., (m-z)=n, and z is invariant or constant across all possible scales

In the 5 trades, workers are expected to read, consult, and fill a range of documents, from simple forms requiring dates, times, or measurements to detailed reports to engineers, inspectors, or customers. The “Germany – All trades” scores reflect our assumption that newcomers who have had basic English language training have the skills to handle simple documents – these often provide or require numerical information such as readings or measurements. We also assumed that newcomers would be able to understand simple instructions (written or spoken) but would not have the technical language skills required to direct small teams or take an active part in group discussions such as pre-job conferences or tailboards.

We used the classification and color scheme listed in Table 7 below.

Table 7. Complexity level¹² for essential skills cross-referenced to CEFR

Essential Skill complexity rating descriptor	CEFR	Complexity Level
<ul style="list-style-type: none"> • Not present 	-	0
<ul style="list-style-type: none"> • Read relatively short texts to locate a single piece of information. • Follow simple written directions. 	A1 / A2	1

¹⁰ http://www.coe.int/t/dg4/linguistic/Cadre1_en.asp accessed 24 September 2016

¹¹ Bond, T. & Fox, C. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences* (2nd). Mahwah, NJ

¹² http://www.esdc.gc.ca/en/essential_skills/profiles/readersguide.page accessed 24 September 2016

Essential Skill complexity rating descriptor	CEFR	Complexity Level
<ul style="list-style-type: none"> • Read more complex texts to locate a single piece of information or read simpler texts to locate multiple pieces of information. • Make low-level inferences. 	B1	2
<ul style="list-style-type: none"> • Choose and integrate information from various sources or from several parts of a single text. • Make low-level inferences from multiple sources. • Identify relevant and irrelevant information. 	B2	3
<ul style="list-style-type: none"> • Integrate and synthesize information from multiple sources or from complex and lengthy texts. • Make complex inferences and use general background knowledge. • Evaluate quality of text. 	C1	4
<ul style="list-style-type: none"> • Interpret dense and complex texts. • Make high-level inferences and use specialized knowledge. 	C2	5

Training Contents: GACs, Competencies, and Rating Scale

Rank-ordering GACs

We assumed that the in-school training hours assigned to any given GAC reflect the relative importance of that aspect of the trade. Further, we assumed that proportion of total training hours dedicated to any aspect of the trade reflect the frequency with which that aspect of the trade is practiced in the field.

We used the BC program outline posted on the ITA website as the reference document. We first listed all the General Areas of Competence (“Lines” or GACs) with the respective percentage of instructional time by level of apprenticeship. We calculated the number of hours devoted to each of these GACs by multiplying the training time allotment - over 4 levels - in percent by the number of training hours for each level and then summed these values.

$$\sum_{i=1}^4 (\%_{instructional\ time})(instructional\ time_{level}) \quad (1)$$

We divided this sum into the total program instructional time and expressed the quotient in percentage, then used this percentage and multiplied it by the on-the-job program hours.

$$\left(\frac{\sum_{i=1}^4 (\%_{instructional\ time})(instructional\ time_{level})}{Total_{instructional\ time}} \right) (Hours_{OJT}) \quad (2)$$

Then we rank-ordered the GACs from largest number of program hours to smallest number of program hours.

Due to scope constraints, we did not perform the same analysis at the competency level.

Competency rating scale

Unlike the ITA documents, German documents are less prescriptive when it comes to training hours, focussing instead on competence attainment (ranging from 1-8 based on the marks earned on in-school theory and practical exams during the training and at the final assessment).

Given the lack of time markers in German trade training, we decided to limit our competency ratings on a three-point basis, using the following protocol:

- **0 (zero)** for BC competencies that are not mentioned in the German documents.
- **1 (one)** for BC competencies that are partially covered by those described in the German documents.
- **2 (two)** for BC competencies that are completely covered by with those described in the German documents.

The GAC rating is the rounded mean of the constituent competency ratings.

Results

Essential Skills

Refer to the Methodology session, Table 7 for complexity rating explanation and color code.

Most German Trade workers master basic English and the ratings reflect this. Lack of familiarity with North American English trade technical terms, complex specialized documents, the imperial system (used interchangeably with the SI system in construction), standards, codes (fire, building, plumbing, etc.), regulations, and business practices would put a German trade Newcomer at a disadvantage.

Table 8. Detailed Essential Skills requirements by trade cross-referenced to "Most German Trade Newcomers" skills

Essential Skills (by profile)	Trade					
	Carp.	C.E.	C.C.W.	Plumb.	Roof.	Germ.
Reading						
Read instructions and warnings written on signs, labels and packaging.	1	1	1	0	1	1
Read short text entries on forms and technical drawings.	1	1	1	1	1	1
Read notices and bulletins.	2	2	2	2	2	1
Read a variety of instructions, procedures, and workplace safety materials.	2	2	2	2	1	0
Read safety-related information, and equipment use instructions.	3	3	3	3	2	0
May read trade journals, brochures and website articles to learn about new products and technologies.	3	3	3	3	2	0
May read manuals, and instructions and procedures contained in manuals.	3	3	3	3	3	0
May read technical reports and trade textbooks.	4	0	0	4	0	0
Read and interpret building codes, regulations, bylaws and standards.	4	4	0	4	3	0
"Average"	2.56	2.11	1.67	2.44	1.67	0.33
Document use						
Scan labels on product packaging and equipment to locate specifications, times, safety information and identification numbers.	1	1	1	1	1	1
View digital readouts, and readings on equipment.	0	1	1	0	0	1
Refer to lists to identify identification numbers and quantities.	0	2	1	2	2	1
Locate and enter data on labels.	1	3	0	1	2	1
Complete a variety of forms and check boxes; enter dates, times, and identification numbers.	2	3	2	2	2	1
Locate data, such as dates, times and dimensions, in tables and conversion charts.	3	3	2	3	2	1
May interpret technical drawings including floor plans, schematics, and assembly drawings.	3	4	3	4	3	1
Complete complex entry forms and building permits.	3	4	0	0	0	0

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Essential Skills (by profile)	Trade					
	Carp.	C.E.	C.C.W.	Plumb.	Roof.	Germ.
Study a variety of plan, elevation, detail, elevation and section drawings.	4	4	0	4	3	1
"Average"	1.89	2.78	1.11	1.89	1.67	0.89
Writing						
Write short comments in log books to, e.g., record the outcome of safety inspections.	1	1	1	1	1	0
Write short notes to co-workers to, e.g., inform them about defective equipment.	1	0	1	1	0	0
May write text entries in forms.	2	2	2	2	0	0
May write short reports to describe events leading up to workplace accidents.	2	2	2	2	1	0
Write comments in forms, schedules, job hazard assessment forms.	2	3	0	0	0	0
"Average"	1.60	1.60	1.20	1.20	0.40	0.00
Numeracy						
May purchase supplies using petty cash and receive change.	1	0	1	1	1	1
Take a variety of measurements using basic tools.	1	1	1	1	2	1
Measure the dimensions and angles using basic tools.	0	1	1	1	2	1
Compare measurements to specifications.	1	1	1	1	2	1
May estimate distances.	0	1	1	0	0	1
Calculate material requirements.	2	2	2	2	3	1
May calculate averages.	2	2	2	2	1	2
May estimate quantities.	2	2	2	2	2	1
Estimate the length of time that it will take to complete projects.	2	1	0	2	3	0
May estimate weights.	0	2	2	3	2	1
May schedule the completion of construction.	2	2	0	3	3	0
Calculate amounts for estimates and invoices.	3	2	0	3	3	0
May take precise measurements using specialized measuring instruments.	3	3	3	3	0	1
Calculate runs, rises and offsets.	4	4	0	4	0	1
"Average"	1.64	1.71	1.14	2.00	1.71	0.86
Oral Communication						
Speak to suppliers.	1	1	1	1	1	1
Exchange information with co-workers and other tradespeople.	2	2	2	2	2	1
Participate in group discussions.	2	2	2	0	2	1
Talk to safety and building inspectors.	2	2	0	2	2	0

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Essential Skills (by profile)	Trade					
	Carp.	C.E.	C.C.W.	Plumb.	Roof.	Germ.
Speak with manufacturer representatives.	2	0	0	0	1	0
Listen to instructions.	0	0	3	0	0	1
Speak with customers.	3	3	0	2	3	0
May provide detailed instructions to co-workers.	3	3	0	3	1	0
Interact with co-workers regarding critical safety issues.	0	3	0	0	3	1
Exchange information with engineers, owners, architects, inspectors and other trades.	0	3	0	0	0	0
"Average"	1.50	1.90	0.80	1.00	1.50	0.50

Health and Safety, and other legislated skills

We have assessed the skill level of newcomers with Canadian and BC OSH, as well as code requirements as non-existent. It is probable that some form of requirement exists in Germany but it is most likely different from those in BC.

We have applied that reasoning to WorkSafeBC (WSBC) rights and responsibilities for workers – and “new” workers, Fall Protection, and Confined Space requirement.

We have applied that reasoning to Federal legislation that covers Workplace Hazardous Materials Information System (WHMIS) as a requirement for all types of work and workplace.

And we have applied that reasoning to the codes relevant to their occupation as necessary. We have included a special consideration for plumbers who, in BC, are expected to have a “Gas B License”.

We have assumed that trade persons are often expected to drive a company vehicle – most likely a pick-up truck or van. These vehicles can be operated with a Class 5 BC Driver’s License. ICBC has an agreement in place to exchange a German driver’s license for a BC one.

Table 9. Regulatory requirements for 5 trades - training (and certification) may be undertaken by the employer (refer to Table 7 for complexity rating explanation and color code)

Regulatory requirements	Trade				
	Carp.	C.E.	C.C.W.	Plumb.	Roof.
WSBC Rights					
Right to a healthy and safe workplace	0	0	0	0	0
Right to safety training and orientation	0	0	0	0	0
Right to refuse unsafe work	0	0	0	0	0
WSBC Responsibilities					
Young / New Worker (Training & Orientation)	0	0	0	0	0
Follow safe work procedures and act safely in the workplace at all times.	0	0	0	0	0
Use the protective clothing, devices, and equipment provided. Be sure to wear them properly.	0	0	0	0	0

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Regulatory requirements	Trade				
	Carp.	C.E.	C.C.W.	Plumb.	Roof.
Co-operate with joint occupational health and safety committees, worker health and safety representatives, WorkSafeBC prevention officers, and anybody with health and safety duties.	0	0	0	0	0
Miscellaneous Requirements					
WHMIS	0	0	0	0	0
Fall arrest / restraint / protection	1	1	1	N/A	1
Confined space	N/A	1	N/A	1	N/A
Building Code	0	N/A	0	0	0
Gas Code (B 149.1)	N/A	N/A	N/A	0	N/A
Canadian Electrical Code	N/A	0	N/A	0	N/A
Driver's License (Class 5)	5	5	5	5	5

Training programs comparisons

In the table below, we compare key structural and procedural elements of the apprenticeship programs in BC and in Germany. Note that we have only considered the dual stream and, for scope reasons, have not included access to German certification based on time-in-the trade or on the strictly vocational stream.

Table 10. Comparison of BC and German apprenticeship program elements across 5 trades

Program element		British Columbia	Germany (dual stream)
Entry requirements	Type	Recommended	Recommended
	Special requirements	None	Physical examination for apprentices <18 years; Recommended physical abilities
	Lowest scholastic	Grade 9 (Roofer)	All trades; 9 years of schooling; certificate from Lower Secondary school (<i>Hauptschule</i>)
	Preferred scholastic	Grade 10 (Carpenter, Construction Craft Worker, Roofer)	All trades; 10 years of schooling; certificate from Intermediate Secondary school (<i>Realschule</i>)
	Highest scholastic	Grade 12 (Plumber) Grade 12 (Electrician)	All trades; 12 years of schooling; certificate from Upper Secondary school (<i>Gymnasium</i>)
	Topics scholastic	English, math, science	Math, science, socials, English (+)
In-school training	Total length	Varies (0 - 1200 hours total)	Varies (900 – 1320 hours total)

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Program element		British Columbia	Germany (dual stream)
	Number of periods	Varies (3-4)	Fixed (3)
	Additional studies		Some compulsory self-directed modules
On-the-job training	Total length	Fixed for each trade, but varies by trade (3600 –6480 hours)	Fixed minima (2 years ≈ 1371 hours ¹³) same for all trades
	Number of periods	Fixed but varies by trade	Fixed with a minimum of 2 years and a maximum of 3.5 years
Assessment	School-based exams	Institution-specific (moving to standardized tests)	Standardized
	On-the-job	Employer hours sign-off	Documented standardized competence tests on site
	Certification	“Paper-and-pencil” single test	“Guild”-controlled theory and competence tests

Training Contents Comparison

Carpenter programs comparison at-a-glance

Table 11. BC and German Carpenter apprenticeships; duration and prerequisites (Note: German reference is the Dual Stream)

British Columbia - Carpenter	Germany dual stream - Carpenter
Level 1 In-school training: 210 hours	Year 1 in-school training: est. 360-720 hours
Level 2 In-school training: 210 hours	Year 2 in-school training: est. 360-720 hours
Level 3 In-school training: 210 hours	Year 3 in-school training: est. 360-720 hours
Level 4 In-school training: 210 hours	
Total in-school: 840 hours	Total in-school: 1080 – 2160 hours
Total work based: 6480 accumulated work based hours	Total work base: 3090 – 4050 hours
Recommended entry: Grade 10 English, Math, and Science	The minimum educational requirements are 9 years of schooling but are determined by the employer – most prefer 12 years.

Carpenter GACs and Competencies comparison (details)

In the table below we list all of the GACs and attendant competencies rated as described above. The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from stronger trade differentiations in Germany.

Table 12. Rank-ordered Carpenter GACs and competencies (0=not present in German program; 1=partial overlap; 2=substantial or complete overlap with BC program)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Wood Frame Construction	191.1	23%	1474	1
Describe Wood Frame Construction				0
Select Framing Materials				1

¹³ https://en.wikipedia.org/wiki/Working_time#European_Union accessed 30 September 2016. OECD 2014 figures.

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General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Build Floor Systems				0
Build Wall Systems				1
Build Stair Systems				2
Build Roof Systems				2
Build Specialized Framing Systems				1
Perform Renovations and Additions				0
Build Timber and Engineered Wood Construction				2
Build Decks and Exterior Structures				1
Concrete Formwork	161.7	19%	1247	0
Use Concrete Types, Materials, Additives and Treatments				0
Select Concrete Forming Systems				0
Build Footing and Vertical Formwork				0
Build Slab-On-Grade Forms and Suspended Slab Forms				0
Install Reinforcement and Embedded Items				0
Build Concrete Stair Forms				0
Place and Finish Concrete				0
Install Specialized Formwork				0
Documentation and Organizational Skills	157.5	19%	1215	1
Describe Carpentry Trade				0
Use Construction Drawings and Specifications				2
Interpret Building Codes and Bylaws				0
Plan and Organize Work				2
Perform Trade Math				2
Finishing Materials	96.6	12%	745.2	1
Describe Roofing Materials				0
Install Doors and Hardware				2
Install Windows and Hardware				1
Install Exterior Finishes				2
Install Interior Finishes				0
Install Cabinets				0
Install Interior Floor, Ceiling and Wall Systems				1
Tools and Equipment	67.2	8%	518.4	2
Use Hand Tools				2
Use Portable Power Tools				2

[A Comparison of Select British Columbia and German Apprenticeships](#)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Use Stationary Power Tools				2
Use Oxy-Fuel Equipment				0
Survey Instruments and Equipment	50.4	6%	388.8	2
Use Levelling Instruments and Equipment				2
Use Site Layout Equipment				1
Building Science	35.7	4%	275.4	2
Control the Forces Acting on a Building				2
Control Heat and Sound Transmission				2
Control Air and Moisture Movement in Buildings				2
Site Layout	33.6	4%	259.2	0
Lay Out Building Locations				1
Prepare Building Site				1
Apply Excavation and Shoring Practices				0
Access, Rigging and Hoisting Equipment	25.2	3%	194.4	1
Use Ladders, Scaffolds and Access Equipment				2
Use Rigging and Hoisting Equipment				0
Safe Work Practices	21	3%	162	1
Apply Shop and Site Safety Practices				1
Apply Personal Safety Practices				1

[Construction Electrician programs comparison at-a-glance](#)

Table 13. Construction electrician and Electrical duration and prerequisites

British Columbia – Construction Electrician	Germany dual stream - Electrician
Level 1 In-school training: 300 hours	Year 1 in-school training: est. 360-720 hours
Level 2 In-school training: 300 hours	Year 2 in-school training: est. 360-720 hours
Level 3 In-school training: 300 hours	Year 3 in-school training: est. 360-720 hours
Level 4 In-school training: 300 hours	
Approximate in-school: 1200 hours	Total in-school: 1080 – 2160 hours
Total work based: 6000 accumulated work based hours	Total work base: 3090 – 4050 hours
Recommended but not required: recent Grade 12 graduation (within 5 yrs) with demonstrated mechanical aptitude; Math and Physics 11; English or Communications 12; or successful completion of an electrical industry assessment exam; or recent (with 5 yrs) Electrical Foundation Program graduate.	The minimum educational requirements are 9 years of schooling but are determined by the employer – most prefer 12 years.

[Construction Electrician GACs and Competencies comparison \(details\)](#)

[A Comparison of Select British Columbia and German Apprenticeships](#)

In the table below we list all of the GACs and attendant competencies rated as described above. The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from stronger trade differentiations in Germany where the trade certificate refers to *Elektroanlagenmonteur / Elektroanlagenmonteurin* (translated roughly as “Electrical Systems Mechanic”)

Table 14. Rank-ordered Construction Electrician GACs and competencies (0=not present in German program; 1=partial overlap; 2=substantial or complete overlap with BC program)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Apply Circuit Concepts	441	2205	37%	1
Use Electrical Circuit Concepts				1
Analyze DC Circuits				1
Solve Problems Using the Principles of Electromagnetism				1
Analyze Single-phase AC Circuits				1
Analyze Three-phase Circuits				1
Analyze Electronic Circuits				1
Install Electrical Equipment	210	1050	18%	2
Install Lighting and Lighting Controls				2
Install Transformers				1
Install Protective Devices				2
Install DC Motors and Generators				0
Install AC Motors and Alternators				2
Install HVAC				1
Install Emergency Power Systems				2
Install Alternative Power Systems				2
Install Low Voltage Distribution Systems	168	840	14%	2
Apply Codes, Regulations and Standards				0
Install Service Equipment				2
Install Grounding and Bonding				2
Install Distribution Centres				2
Install Raceways, Boxes and Fittings				2
Install Conductors and Cables				2
Install Utilization Equipment and Devices				2
Install Control Circuits and Devices	168	840	14%	2
Install Manual Motor Controls				2
Install Magnetic Motor Controls				1
Install Electronic Motor Controls				2
Install PLCs				1
Install Automated Controls				2

A Comparison of Select British Columbia and German Apprenticeships

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Read and Interpret Drawings and Manuals	75	375	6%	1
Use Circuit Drawings				1
Use Construction Drawings and Specifications				1
Use Manuals and Manufacturers' Instructions				0
Plan Time and Materials				2
Install Signal and Communications Systems	42	210	4%	2
Install Fire Alarm and Suppression Systems				1
Install Structured Cabling Systems				2
Install Nurse Call Systems				0
Install Building Integrated Control Systems				2
Install Sound Systems				2
Install Entertainment Systems				2
Install CATV Systems				2
Install Security Alarm Systems				2
Use Test Equipment	42	210	4%	2
Use Analog Meters				2
Use Digital Meters				2
Use Scopes				1
Use Power Quality Analyzers				1
Perform Structured Cable Testing and Reporting				2
Install High Voltage Systems	24	120	2%	0
Apply High Voltage Safety Procedures				0
Install High Voltage Cable				1
Install High Voltage Switch Gear				0
Use High Voltage Test Equipment				1
Use Safe Work Practices	18	90	2%	2
Perform Lockout Procedures				2
Apply WCB Standards and Regulations				0
Apply Safe Work Practices				2
Apply WHMIS				0
Use a Daily Safety Plan				2
Use Safe Rigging Techniques				1
Use Essential Skills	12	60	1%	0
Use Tools and Equipment	0	0	0%	1
Use Hand Tools				1

[A Comparison of Select British Columbia and German Apprenticeships](#)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Use Power Tools				1
Use Fastening Systems				1
Use Powder Actuated Tools				1
Use Access Equipment				1

Plumbers programs comparison at-a-glance

Table 15. BC Plumber and Germany Plumber duration and prerequisites

British Columbia – Plumber	Germany dual stream - Plumber
Level 1 In-school training: 180 hours	Year 1 in-school training: est. 360-720 hours
Level 2 In-school training: 180 hours	Year 2 in-school training: est. 360-720 hours
Level 3 In-school training: 180 hours	Year 3 in-school training: est. 360-720 hours
Level 4 In-school training: 240 hours	½ Year 4 in-school training: est. 90-360 hours
Total in-school: 780 hours	Total in-school: 1120 – 2500 hours
Total work based: 6420 accumulated work based hours	Total work base: 3600 – 4725 hours
Recommended but not required: Grade 12 English, Grade 11 Algebra or Trade Math 11, Grade 11 Physics or Science and Technology 11	The minimum educational requirements are 9 years of schooling but are determined by the employer – most prefer 12 years.

Plumbers GACs and Competencies comparison (details)

In the table below we list all of the GACs and attendant competencies rated as described above. The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from stronger trade differentiations / specialization in Germany where the trade certificate refers to *Anlagenmechaniker/in* and the usual *Klempner/in* (literally Plumber) refers to a sheet metal worker specializing in duct work.

Table 16. Rank-ordered Plumber GACs and competencies (0=not present in German program; 1=partial overlap; 2=substantial or complete overlap with BC program)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Install Natural Gas and Propane Systems	192	1580	25%	0
Install and service fuel systems				1
Install and service gas equipment				0
Install venting and air supply				1
Install and service controls and safeguards				1
Use gas codes, regulations and standards				0
Organize Work	122.5	1009	16%	2
Use mathematics and science				2
Read drawings and specifications				2
Use codes, regulations and standards				0

A Comparison of Select British Columbia and German Apprenticeships

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Use manufacturer and supplier documentation				1
Plan a project				2
Install Sanitary and Storm Drainage Systems	113.8	936.3	15%	2
Install sanitary drain, waste and vent systems				2
Install storm drainage systems				2
Install sanitary sewer systems				2
Test and commission sanitary and storm drainage systems				2
Maintain and repair sanitary and storm drainage systems				2
Install Water Service and Distribution	96	790.1	12%	2
Install water services				2
Install potable distribution systems				2
Install private potable water supply systems				0
Install water treatment systems				1
Test and commission potable water systems				2
Maintain and repair potable water systems				2
Install Hydronic Heating and Cooling	77.04	634.1	10%	1
Describe the operation of hydronic heating and cooling systems				0
Install hydronic heating and cooling systems				1
Test and commission hydronic systems				1
Maintain and repair hydronic systems				1
Use Tools and Equipment	55.28	455	7%	2
Use hand tools				2
Use portable power tools				2
Use stationary power tools				2
Use measuring and leveling tools				2
Use cutting, brazing, and soldering equipment				2
Use ladders and platforms				1
Use rigging and hoisting equipment				0
Prepare and Assemble Plumbing Components	35.1	288.9	4%	2
Install pipes				2
Install valves				2
Install fittings				2

A Comparison of Select British Columbia and German Apprenticeships

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Penetrate structures				0
Apply Plumbing Principles	23.32	191.9	3%	2
Install Fixtures and Appliances	22.4	184.4	3%	1
Install fixtures and trims				2
Install appliances				0
Test and commission fixtures and appliances				1
Maintain and repair fixtures and appliances				1
Install Specialized Systems	18.42	151.6	2%	1
Install medical gas systems				0
Install irrigation systems				0
Install compressed air systems				1
Install fire protection systems				1
Test and commission specialized systems				1
Maintain and repair specialized systems				1
Use Safe Work Practices	12.42	102.2	2%	1
Control workplace hazards				2
Use information in the OSH Regulation and WCB standards				0
Use WHMIS				0
Use Personal Protective Equipment				2
Practice fire prevention				0
Install Private Sewage Systems	11.76	96.79	2%	1
Install private sewage disposal systems				1
Repair and maintain private sewage disposal systems				1

Construction Craft Workers programs comparison at-a-glance

Table 17.BC Construction Craft Worker and Germany Construction Craft Worker (concrete) duration and prerequisites

British Columbia – Construction Craft Worker	Germany dual stream - Construction Craft Worker (concrete)
Level 1 In-school training: 120 hours	Year 1 in-school training: est. 360-720 hours
Level 2 In-school training: 120 hours	Year 2 in-school training: est. 360-720 hours
Total in-school: 780 hours	Total in-school: 720 – 1440 hours
Total work based: 4000 accumulated work based hours	Total work base: 2060 – 2780 hours
Recommended but not required: Grade 12 English, Grade 11 Algebra or Trade Math 11, Grade 11 Physics or Science and Technology 11	The minimum educational requirements are 9 years of schooling but are determined by the employer – most prefer 12 years. Math, physics, and shop skills are emphasized.

[A Comparison of Select British Columbia and German Apprenticeships](#)

Construction Craft Workers GACs and Competencies comparison (details)

In the table below we list all of the GACs and attendant competencies rated as described above. The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from stronger trade differentiations within the Construction Craft worker stream.

Table 18. Rank-ordered Construction Craft Worker GACs and competencies (0=not present in German program; 1=partial overlap; 2=substantial or complete overlap with BC program; Note: we used the “Concrete” specialization as a reference)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Perform Concrete Work	45.6	19%	760	2
Form Concrete				2
Place and Finish Concrete				2
Modify Concrete				2
Install Grout, Epoxies and Caulking				1
Perform Site Work	43.2	18%	720	2
Prepare Site				2
Perform Ground Work				2
Perform Demolition				0
Apply Excavation and Shoring Practices				2
Service Site				2
Use Scaffolding and Access Equipment	27.6	12%	460	2
Use Scaffolding and Access Equipment				2
Use access equipment				1
Perform Utilities and Pipeline Tasks	26.4	11%	440	0
Install utility piping				0
Perform pipeline activities				0
Perform pipeline maintenance				0
Organize Work	24	10%	400	2
Use Documentation, Blueprints and Specifications				2
Communicate with Others				2
Use Basic Trade Math				2
Perform Routine Trade Activities	24	10%	400	1
Install Permanent and Temporary Fencing				1
Erect and Dismantle Hoarding / Enclosures				1
Perform Traffic Control				0
Establish Grades and Elevations				2
Handle Materials				1
Install Membranes				1
Install Insulating Materials				2

A Comparison of Select British Columbia and German Apprenticeships

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Use Safe Work Practices	18	8%	300	1
Manage Workplace Hazards				1
Apply OHS Regulations and WorkSafeBC Standards				0
Use Fall Protection Systems and Equipment				1
Use Personal Protective Equipment				1
Use Fire Safety Procedures				1
Use Safety Committees				0
Perform Safety Watch				0
Use Tools and Equipment	12	5%	200	1
Use hand tools				2
Use power tools				2
Use powder-actuated tools				1
Use Rigging and Hoisting Equipment				1
Use portable equipment				1
Use mobile equipment				1
Use sandblasters				0
Use packers				0
Perform Masonry Work	12	5%	200	0
Prepare masonry work				0
Tend to bricklayers				0
Perform Roadwork	7.2	3%	120	0
Install paving materials				0
Install roadwork components				0

Rofer (Damp- and Waterproof) programs comparison at-a-glance

Table 19. BC and German Roofer apprenticeships; duration and prerequisites (Note: German reference is the Dual Stream)

British Columbia - Roofer	Germany dual stream - Roofer
Level 1 In-school training: 120 hours	Year 1 in-school training: est. 360-720 hours
Level 2 In-school training: 120 hours	Year 2 in-school training: est. 360-720 hours
Level 3 In-school training: 120 hours	Year 3 in-school training: est. 360-720 hours
Total in-school: 360 hours	Total in-school: 1080 – 2160 hours
Total work based: 6480 accumulated work based hours	Total work base: 3090 – 4050 hours
Recommended entry: Grade 10 English, Math, and Science	The minimum educational requirements are 9 years of schooling but are determined by the employer – most prefer 12 years.

[A Comparison of Select British Columbia and German Apprenticeships](#)

[Roofer \(Damp- and Waterproofer GACs and Competencies comparison \(details\)\)](#)

In the table below we list all of the GACs and attendant competencies rated as described above. The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from 2 specializations and the differences in most common roofing materials.

Table 20. Rank-ordered Construction Roofer GACs and competencies (0=not present in German program; 1=partial overlap; 2=substantial or complete overlap with BC program; Note: we used the “Roof, wall and waterproofing technology” specialization as a reference)

General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Install Low Slope and Flat Roofing	138.0	1380	38%	2
Install Gypsum Board and Insulation				1
Install Overlay Board				1
Install Vapour Retarders and Air Barriers				2
Install Flashing Materials				2
Install Built-Up Roofing Systems				2
Install Flexible Membrane Roof Systems				2
Install Steep Roofing	55.2	552	15%	2
Install Asphalt Shingles				1
Install Wood Shingles and Shakes				0
Install Concrete and Composite Materials				2
Install Metallic Materials				2
Organize Work	45.6	456	13%	2
Describe Roof Types				1
Communicate with others				2
Prepare the worksite				2
Estimate quantities of materials				2
Use Safe Work Practices	44.4	444	12%	1
Describe Workplace Hazards				2
Interpret the Occupational Health and Safety Regulation and WCB Standards				0
Use WHMIS				0
Use Personal Protective Equipment				2
Use fire safety procedures				2
Use Documentation	32.4	324	9%	2
Read Drawings and Specifications				2
Use Building Codes and RCABC Standards				0
Read Manufacturers’ Information				1
Use Tools and Equipment	21.6	216	6%	2
Use hand tools				2
Use portable power tools				2
Use propane-fuelled equipment				1

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General Area of Competence (GAC)	In-school hours	%/GAC	On-the-job hours	Rating
Competencies				Germany
Use hot process equipment				1
Use Hoisting, Lifting and Rigging Equipment				2
Use Motorized Equipment				1
Use Ladders and Platforms				2
Assess and Maintain Roof, Damp and Waterproofing	12.0	120	3%	2
Assess Roof Conditions				2
Maintain and Repair Roofs, Damp and Waterproofing				2
Apply Waterproofing and Damp-Proofing	7.2	72	2%	2
Waterproof surfaces				2
Damp-proof surfaces				2
Prepare Roofs	3.6	36	1%	2
Prepare Roofs For Replacement				2
Prepare Roofs For New Installation				2

Discussion

In this section we consider the meaning of the results.

Essential Skills

Reading

The overall score on 0.33 reflects our assumption that German trade persons have had rudimentary training in English. But this assumption sets the bar at its lowest: it is possible that some newcomers master English at a more advanced level. However, it is safe to assume that (limited) English fluency would not include familiarity with safety, trade or legislation technical terms, trade processes language (including trade jargon), or codes and regulations (often in legalistic language and non-intuitive formats.)

In addition, reception (listening and reading – A1/A2), reading tending to be a more complex literacy skill than listening (and understanding), this, even more so in a specialized field.

Document Use

The overall score on 0.89 reflects the language assumption we mentioned above. We can expect a German newcomer with basic English to be able to handle most common documents, especially plans, schematics, blueprints etc. The German trade person's limitations would be linked to differing protocols embedded in the plans rather than the language skills. The only skill we thought might be out of a German trade person is that of completing complex forms and building permits (score of 0). Here we have assumed that both language and process worked synergistically.

The literacy skill required here is that most complex skill of mediation (translating and interpreting - C1/C2). But German trade persons have had to practice that skill in their day-to-day practice in their home country. In BC their only impediment is that of having to apply the skill in a foreign language.

Writing

The overall score on 0 reflects both the language assumption we mentioned above and the fact that both written production (written – B1) and document “interaction” (B2) are more difficult for non-native or non-fluent writers.

Reception (listening and reading – A1/A2) < production (spoken and written – B1) < interaction (spoken and written – B2) < mediation (translating and interpreting – C1/C2).

Numeracy

The overall score on 0.86 reflects the language assumption even though its importance is not as great here as it is in the other essential skills categories. We can expect a German newcomer to be able to handle most common tasks requiring trade mathematics. The only numeracy skills we thought might be out of a German trade person's ken is that of scheduling and estimating costs and time-to-completion (scores of 0). Here we have assumed that lack of familiarity with the industry in a BC context was the greater impediment, perhaps made more difficult when paired with limited English skills.

Oral communications

The overall score on 0.50 reflects the language assumption and the complexity level: interaction (spoken – B2) < mediation (translating and interpreting – C1/C2). Language demands such as understanding simple requests, what is said at crew meetings, or what a customer might want ought to be within the grasp of a newcomer with basic English language skills. But talking to building and safety inspectors,

engineers, manufacturers, or acting as a crew leader might be beyond a German trade person's abilities (scores of 0). Here as well, lack of familiarity with the industry in a BC context is a major contributing factor, especially when paired with limited English skills.

Essential Skills recommendations

Clearly, English language skills are the major stumbling block to German trade person, especially given the educational requirements of the German apprenticeship programs. But offering generic English Second Language (ESL) courses, while useful for integration into the larger community, will not help on the job site.

For that, an educational approach supported by a job aid is probably the best intervention. The educational component would be in 2 parts: (i) trade and legalistic English and (ii) worksite protocols and business processes, both making use of documents, such as regulations or codes, pertinent to the newcomers' trade. The job aid would be a pocket or app-based trade dictionary containing a subset of the most common trade terms and aligned to the BC apprentice trade manual(s).

Health and Safety, and other legislated skills

WorkSafeBC (WSBC) lists rights and responsibilities for workers – and additional training for “new” workers. While compliance is commonly taken care of by the employer, it is up to the trade person to know what they can and cannot do safely, as well as how to be in compliance with WSBC regulation. WSBC requirements with respect to Personal Protective Equipment (PPE) varies from trade to trade but usually includes regulation-approved footwear, clothing (including high visibility clothing), ear/eye/hand protection, and hard hat. In addition, for some types of work, respirator proficiency is required.

Workplace Hazardous Materials Information System (WHMIS) is a requirement for all types of work and workplace. WHMIS certification is often a pre-requisite for jobs – it may be offered through the employer.

Proof of training and a certificate in Fall Prevention (covered under Part 11 of the WSBC Regulation) is a requirement for all workers who work at heights exceeding 3 meters. And while it is possible to work without fall restraint (for example if guardrails have been installed), roofers and carpenters will often be required to have and know how to use fall restraint equipment.

Electricians and plumbers often work in confined spaces (covered under Part 9 of the WSBC Regulation). Proof of training and a certificate is required for those workers who might come across such environments.

For all construction trades a familiarity with the codes relevant to their occupation is necessary. In addition, plumbers in BC are expected to have a “Gas B License” in order to install and connect gas-fired appliances.

Trade persons are often expected to drive a company vehicle – most likely a pick-up truck or van. These vehicles can be operated with a Class 5 BC Driver's License. ICBC has an agreement in place to exchange a German driver's license for a BC one provided a certified translated copy of the document is provided alongside proof of at least 2 years' driving experience either in the form of a formal letter or as attested by the issuance date on the driver's license itself. Operating commercial vehicles with more than 2 axles, especially those equipped with air brakes requires a special license and an air brake endorsement.

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[Health and Safety, and other legislated skills recommendations](#)

There are a number of online training opportunities for all of the OSH requirements that are appropriate and recognized. These can be purchased for approximately \$200.

Code books (or relevant appropriate section) can be purchased for \$150-250 online or at specialized bookstores – knowing the code will be important for those workers wanting to challenge the Red Seal examination, especially for Plumbers and Electricians.

Plumbers wishing to install and connect gas-fired appliances will have to take a course and pass the relevant Safety Authority examination.

[Training Contents Comparisons](#)

[Carpenter](#)

The differences between trade practices in BC and Germany stem from historically entrained building technologies and practices, existing asset base, and stronger trade differentiations in Germany. Briefly, in Germany carpenters do not routinely

- Direct excavations and build shoring.
- Direct lifts or hoist materials.
- Build formwork, use rebar, order and place concrete.
- “Stick-frame” but, instead timber-frame.
- Hang and finish drywall.
- Install cabinetry.

[Carpenter recommendations](#)

German carpenters have the skills to be productive on a worksite. But they miss some of the skills required to be deployed flexibly – say on a residential framing crew, or to work on residential tower, industrial, or commercial projects that make heavy use of forming and concrete components. Providing them with the in-school equivalent of H line in Level 1 (approximately 2 weeks) and G Line in Level 2 (approximately 4 weeks) of the apprenticeship program would bring them up to speed.

Alternatively, they could pick up these skills on the job if they were employed as a Construction Craft Worker, whether as an apprentice or a laborer, getting to Red Seal certification in 2-3 years.

[Construction Electrician](#)

The differences between trade practices in BC and Germany stem from technologies, codes and regulations, and electrical distribution systems, including voltage differences. Briefly, in Germany electricians do not

- Expressly study “essential skills”; these are acquired prior to entry in the dual system.
- Expressly study electrical theory and schematics (their knowledge is taken for granted).
- Routinely conduct high voltage installation.

[Construction Electrician recommendations](#)

German electricians have the skills to be productive on a worksite. But they will need to adapt to base voltage differences between Europe and Canada. Likewise, codes and regulations driving work practices will be foreign to them. Providing them with the in-school equivalent of K line in Level 4 (approximately

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1 week) of the apprenticeship program and an Electrical Code course (approximately 2 weeks a day/week and \$600) would bring them up to speed.

Alternatively, they could pick up these skills on the job, getting to Red Seal certification in a year or so.

[Plumber](#)

The differences between trade practices in BC and Germany stem from technologies, codes and regulations, and distribution systems. The differences between trade practices in BC and Germany also stem from stronger trade differentiations / specialization in Germany where the trade certificate refers to *Anlagenmechaniker/in* and the usual *Klempner/in* (literally Plumber) refers to a sheet metal worker specializing in duct work and water evacuation systems. This differentiation may also be due to the focus of this analysis on the dual stream only – in Germany “additional certificates” and “purely vocational” training lead to different credentials but also to different specializations within the trade.

Note here that German “plumbers” install wood-fired heating and boiler systems rather than gas-fired ones, and that they also install HVAC systems (unlike BC Plumbers).

Briefly, in Germany “Plumbers” do not

- Install and service natural gas and propane heating systems.
- Install medical gas supply systems.
- Install sprinkling systems.
- Routinely install well and septic systems.

[Plumber recommendations](#)

German plumbers have the skills to be productive on a worksite. But codes and regulations driving work practices will be foreign to them. Providing them with the in-school equivalent of C3 in C line in Level 1 (approximately 1 week) of the apprenticeship program and a Gas B course (approximately 3 weeks and \$1000) would bring them up to speed.

Alternatively, they could pick up code-related skills on the job and take the Gas B course – in order to get the Safety Authority qualification, then challenge the Red Seal examination.

[Construction Craft Worker](#)

The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from stronger trade differentiations within the Construction Craft worker stream. The differences we noted are, in part, a consequence of using the “concrete specialization” program as a German reference. We used this specialization as it better matched the most important aspects of the Construction Craft Worker as practice in BC.

All of the 3 specialization refer to “Building Construction Worker” (*Hochbaufacharbeiter/ in*) The 3 trade differentiations / specialization in Germany refer to “specialising in concrete and reinforced concrete work” (*Schwerpunkt Beton- und Stahlbetonarbeiten*) – the specialization we used for our comparison; “specializing in masonry work” (*Schwerpunkt Maurerarbeiten*); and “specialising in furnace and chimney work” (*Schwerpunkt Feuerungs- und Schornsteinbauarbeiten*).

Note here that German “Building Construction Workers” type of hands-on skills will depend on which stream they took – and which certificate they hold.

Briefly, in Germany “Building Construction Workers - Concrete” do not

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- Do any type of roadwork.
- Do any type of masonry.
- Do duct, utility, or pipeline work.
- Conduct traffic control.

[Construction Craft Worker recommendations](#)

German Building Construction Workers – concrete have the skills to be productive on a worksite. But, codes and regulations driving work practices will be foreign to them. Once over the language barrier (if any) they could pick up code-related, roadwork, piping, and masonry skills on the job and then challenge the Red Seal examination.

[Roofer](#)

The ratings are indicative of the differences between trade practices in BC and Germany – they also stem from the 2 specializations in the Roofer stream. The differences we noted are, in part, a consequence of using the “specializing in roof, wall and waterproofing technology” program as a German reference. We used this specialization as it better matched the most important aspects of the Roofer as practiced in BC.

All of the 2 specialization refer to “Roofer” (*Dachdecker/in*) The 2 trade differentiations / specialization in Germany refer to “specializing in roof, wall and waterproofing technology” (*Fachrichtung Dach-, Wand- und Abdichtungstechnik*) – the specialization we used for our comparison; and “specializing in reed-thatch roofing techniques” (*Fachrichtung Reetdachtechnik*).

Note here that German “Roofers” type of hands-on skills will depend on which stream they took – and which certificate they hold.

Briefly, in Germany “Roofers – roof, wall, and waterproofing” do not

- Routinely install wood shingles and shakes.
- Know local industry standards (in this case Roofing Contractors Association of BC – RCABC).

[Roofer recommendations](#)

German Roofers have the skills to be productive on a worksite, be it flat, low slope, or steep roofing. But, codes, regulations, and industry standards driving work practices will be foreign to them. Once over the language barrier (if any) they could pick up wood shingling skills on the job and then challenge the Red Seal examination.

[Credentialing comparisons](#)

[British Columbia](#)

Apprentices are required to pass each of 4 levels (blocks) of in-school training. At the time of this writing, the practical and theory tests were institution-specific, but coordinated through a BC Articulation Committee for the trade. The Industry Training Authority (ITA) intends to impose standardized level theory tests starting in 2016. There is no standardized practical test: instructors assign cumulative marks for in-school projects (similar but not standardized).

Successful completion of the Level 4 in-school final exam gives access to the Red Seal examination, the only certification mechanism for carpenters in BC.

The Red Seal - Apprentices and challengers

Introduction

Apprentices and approved challengers are required to write the Red Seal examination in order to get a BC carpenter credential. There is no partial credit, no part credential.

The Red Seal examination is a timed “paper and pencil” test. All questions on the examination are machine-scorable multiple choice.

The Red Seal Certification examination is based on the National Occupational Analysis (NOA). The NOA is broken down into a numbers of blocks, tasks, and sub-tasks. Examination questions are based on the sub-tasks, the number of questions on each sub-task is based on a national mathematical average of estimated time spent on task by the carpenters in each jurisdiction, curved to the total number of question on the examination.

There is no weighting of any section of the Red Seal examination based on either heightened safety implications or criticality of task. There is no jurisdictional examination overlay for the Red Seal examination.

Red Seal examinations are prepared cooperatively between all Canadian jurisdictions but are hosted by a designated jurisdiction (designate status for any Red Seal examination is assigned through the CCDA¹⁴'s Product Committee's ISEC¹⁵). Red Seal examinations are item bank-generated; that is for each examinable sub-task of the NOA a number of items are developed and then randomly assigned to an instrument based on a ToS¹⁶ that mirrors the NOA percentages.

Bank-generated examinations are more comprehensive and more “difficult¹⁷” than many of the “before-bank” examinations: items address more areas of the trade at more varied/complex levels than in one-off, instructor-developed examinations.

Problems

It is generally assumed that the ability to pass the examination¹⁸ can be directly attributed to a candidate's work experience: that there is a direct proportional relationship between the level, scope, and quality of on-the-job training (OJT) and experience, and performance on the examination. It is also assumed that the instructional content (and activities) delivered by the institutions reflect the National Occupational Analysis (NOA) - our analysis shows this to be a dubious assumption, at best.

There are a number of problems with these assumptions. First, it is questionable if a pencil and paper test can stand as a proxy for practical ability. Second, it is unclear whether the candidates are able, for the purpose of the test only, to conceptualize what they do in order to answer a "word" problem. Third,

¹⁴ Canadian Council of Directors of Apprenticeship

¹⁵ The *Interprovincial Standards Examination Committee* is made up of provincial/territorial government representatives

¹⁶ A *Table of Specifications* is developed by the host jurisdiction and assigns weights and taxonomic item levels to sub-tasks

¹⁷ Where “difficulty” is a perceptual measure from the candidates' perspective rather than statistically derived through Item Response or Classical theories

¹⁸ 70% aggregate cut score for all Red Seal examinations

domain hierarchy is neither considered nor established. And fourth, the NOA sub-tasks are not worded clearly enough to permit domain definition (e.g. “G21.01 Removes existing materials”).

The third and fourth problems are of interest to the carpenter Red Seal examination because they are borne out of examination development design and practice. As a pencil and paper test, the carpenter IP assumes that all candidates can read, thus making the examination a test of literacy. As well, many items require candidates to apply mathematical concepts in order to identify (not necessarily generate as they would on the job) the correct answer, as such, the Red Seal is a test of numeracy. These two domains are listed in the Essential Skills, but these are not tested for, nor are they part of the requirement for challengers, but they are tested in conjunction with the job skills. All Red Seal examinations are made up of items that test an indeterminate number of domains in an indeterminate fashion.

Success on the Red Seal examination means the candidate scored >70%. All Red Seal examinations have this unique cut score. The cut score is not adjusted to the compounded psychometric profile of the items used for the examination – items are not differentially weighted. And, while results are available at the task level, the score obtained is the unweighted ratio of correct answers over number of questions at the sub-task level.

Validity

Validity is a measure of confidence in the inferences made based on a test score. With high stakes tests (like the Red Seal), it is crucial that test developers and administrators ensure inferences drawn from test scores are accurate. In the case of carpenters, a score <70% means that the candidate is not a competent carpenter, a serious professional issue.

Validation studies are recommended prior to the introduction of any test and should be mandatory for high stakes tests like the carpenter Red Seal. Usually three types of validation studies are conducted: content, criterion-related, and construct. With Red Seal examinations in general, only a cursory content validation is conducted when local experts review items.

Some may argue that the use of subject matter experts (SMEs) during item development is a validation exercise. This is a spurious argument, as content validation exercises ought to be conducted by independent judges, not the people who developed the items. Moreover, there is no indication that the SMEs are fully cognizant of all domains tested, are representative of the population of carpenters, or are able to precisely determine what is being tested.

Reliability

If a test is an accurate measure of an individual’s ability¹⁹, then any candidate’s observed scores should be consistent over a number of tries on the same test or parallel, equated tests. Reliability indices are numerical values that provide a statistical measure of the consistency of test scores; one would expect z-scores of a given individual to remain relatively consistent over repeated tries.

Score consistency is affected both by random and systematic errors. Random errors are chance happening and cannot be controlled (but they can be accounted for). Systematic errors are due to either examination flaws or candidates’ characteristic (e.g. visual impairment). Red Seal examinations are

¹⁹ i.e. that E (the error unrelated to the domain(s) being tested – see footnote 2) is minimized in $T=X+E$ so that the test score (X) is a stable, true reflection of the true score (T),

developed, produced, and implemented without any reliability studies. In fact, some jurisdictions do not track reliability indices, even rudimentary α s or z-scores distributions in or for test-re-test situations.

Germany

Whether an apprentice, a challenger, or a continuing / vocational (adult) education student, all candidates to the German carpenter credential face the same types of summative tests, albeit different in each of the German *Länder*. Access to these summative tests, their content, duration, and scoring, are backstopped by the German Federal Institute for Vocational Education and Training (*Bundesinstitut für Berufsbildung* – BIBB) and are aligned to European Standards.

These summative tests are accessed after the apprentice has successfully completed 2 level test batteries in year one and two of the program. These level tests cover scholastic skills: mathematics and physics, French and social studies, foreign language, and trade skills. The summative tests, taken at the end of the apprenticeship is created and administered by the local “Guild”, a body made up of State, Business, and Union members who practice the trade.

The summative tests are cross-referenced to “end state” or terminal competences.

Validity

The German summative tests are “constructed response” tests. That is, and unlike the Red Seal, the candidate must generate his or her own answer or solution to a given problem. In addition, a German candidate has to demonstrate both cognitive and hands-on abilities. Marks are issued by examiner teams, as opposed to being machine graded, and each examiner team’s assessments build an overall picture of the candidate across all terminal competences. The terminal competences are those the training program and the trade require as minimum proof of competence.

Reliability

Having many tests increase challenges to reliability if we added a reliability index for each test and summed those. One of the mechanisms the Germans are relying on to increase individual tests’ reliability is using multiple raters (and being able to provide an inter-rater reliability index) supplemented by a (at a minimum) two-tiered marking structure – in effect getting two inter-rater values. The German picture is a composite one spread over a battery of tests and it is unlikely that a candidate in a test-re-test situation would do much differently overall.

BC vs. Germany

Table 11 compares the major elements of the testing and credentialing systems for apprentices and trade persons in BC and in Germany. Both systems reflect general beliefs and philosophy about education and training.

Briefly, BC, like most North American jurisdictions, consistent with a greater reliance on technology and quantitative, large scale standardized testing uses a machine scorable test. The Red Seal examinations are designed and produced by a broad-based Canadian consensus, and are managed by a local arms-length government agency, ITA, an institution removed from the training institutions and the field. The Red Seal endorsement is meant to qualify the worker.

By contrast, the German approach is holistic, reflects ideas of citizenship, is imbued with traditional educational values, and is reliant on expert educators and subject matter experts. The credential is meant to qualify the student.

Table 21. Comparison of BC and Germany examination and credentialing

Examination and certification		
Element	BC	Germany
Exam	Single	Multiple
	Pencil & paper	Pencil & paper Hands-on
Domains tested	Multiple unspecified	Multiple specified
	Proxy	Direct
Domain inclusion	Negotiated norm	Criterion
Item type	Selected response	Constructed response
Scoring	Machine	Rubric-based
		Examiner teams
Scores	One correct	Graded
Results	Unique fixed cut score	Compounded
Validity	Medium	Strong
Reliability	Unknown	Strong
Credential	Endorsement	National