ABANA's National Curriculum.
June 5th 2011 version.

This curriculum is limited in its scope and deals only with developing a blacksmith's skills in the forge environment. The lessons are exercises and usually criterion based rather than project based unless required for the Grille Project.

The curriculum has been divided into approximately 24-hour components (levels) – making it teachable within a 3 day week for long week-end courses. It is intended that by adding projects an instructor will boost the curriculum, per level, to a 5-day commitment for use at trade or craft schools.

Individual items have been grouped, where possible, with similar subject materials. Levels can be taught out-of-sequence.

The end outcome of this curriculum is that the student will be eligible for placement under the ABANA/NOMMA agreement

Although this curriculum is forge and anvil based it is anticipated that the student will have some access to equipment such as:
Drill press
Machinist vice
Welder
Oxy/Fuel system

Skill sets:

Forging: [Drawing down, upsetting or spreading the material thereby changing the cross section of the bar]

Taper: Free of hammer marks, straight sided, centered on the bar and following the square, octagon round method of forging.

Spreading: Free of holes and tears. Be of a uniform thickness where appropriate.

Shoulder: Usually, an abrupt change of stock cross-section
Set transition (Definition; shoulder looking like it was made using a set hammer or edge of the anvil) One distinct shoulder (no chatter from miss aligned starts), free of cracks,
Necking in (Definition; gradual transition from one cross-section to another) Smooth and free of hammer marks. Centered on the bar where appropriate

Upsets: Free of cracks, free of lipping and cupping, centered on the bar where appropriate

Forming: [Bending or twisting, changing the orientation of the bar]

Square corners

Upset post-bend: Free of cracks at the inside corner. Full stock width and thickness at the corner. Full stock size on both sides of the corner. The outside of the corner is to be sharp.
Pre-bend upset: Inside of corner to show a large curved fillet. The outside of the corner is to be sharp.
Square corners using a set-transition: (Definition, where the stock on one side of the corner has been reduced in cross section prior to making the corner.)

Scrolls: No cracks at the scroll end (such as behind snub ended scrolls). Free of kinks or straight sections. Smooth decrease in radius from the outside to the inside of the scroll.

Scroll jig: Should show a method of grasping the scroll end in preparation for turning the scroll. This can be in the form of a tab of material protruding from the jig or a jig of a helix construction.

Cutting: [Splitting or punching]

Punched hole: Centered in the bar (where appropriate). Sides of the hole should be of a uniform thickness and shape and not thinned to a point of weakness.

Punched and drifted hole: Centered in bar where appropriate. Straight in its orientation to the bar. Free of cracks. Show no evidence of the initial punched or chiseled hole.

Splitting: Uniform sides, free from rag, protected root of the cut (half round to prevent cracking). Where a split is opened out (as in a fork) the student is encouraged to neck-in (fuller) at a distance equal to the thickness of the sides of the split, behind the split, to prevent cracking.

Pass throughs: Holes should be of a sufficient size and shape to allow the pass through bar to move easily without being sloppy. Evidence of the initial slit or slot is deemed to be an incorrect match of tooling.

Joining:

Forge weld: The ideal forge weld is one that is completely blended in to the bar with no evidence of a joint, tolerance is given to the student if there is some evidence of the weld seam post welding. Cracks caused by overheating or taking an excessive number of heats are not acceptable. Cracks at either toe (of the scarf) are not acceptable. A reduced cross section of the bar compared to the surrounding stock is not acceptable.

Riveting: Rivets should show a sufficiently large mass at the head to prevent them from being pulled from the work. The rivet head should be centered about the main body of the rivet. It is desirable that rivets be made by the student rather than store bought.

Specific points:

General work: The projects and exercises set out below should be returned free of cracks, burns and gross hammer-marks in the bar. The items can be finished with a file, but not ground (except the faces of the leafing and repousse' hammers). Work ground with an abrasive will not be accepted.

Hammer marks in the bar: Using a hand hammer at the anvil will produce a hammer texture on the bar. Excessive texture is defined as one leaving an uneven finish or where one edge (side) of the hammer has left a visible mark in the bar (such as found when not matching the angle of a taper when drawing down a bar and the heel of the hammer is leaving steps in the bar). A smooth hammer texture is expected in the work, but marks from erratic hammering or from the edge of the hammer are not.

Over-forged or over-heated: This description is given to any work that has been overly hammered or heated too many times or burned in the fire. The piece will be too thin for its intended use and may have cracks present in the bar. Students should be asked to repeat the project using fewer blows or heats.

Finish: Projects may be finished in a wax, oil or clear coat finish

Water leaves: Free of holes and cracks/tears. Crimps match (opposite each other). The end of the leaf must show a 'return' to the main leaf. Leaves should show a 'U' shaped channel to allow the placement of a scroll where needed. Edges should be thinned sufficiently to give the leaf a delicate image visually without being over-forged or containing tears.

Acanthus leaves: Free of holes or cracks and tears. Match curve of scroll

Leafing Hammer: Drawn eye, appropriately shaped for use at either the anvil or the vise. Heat treated or case hardened.

Tenons: Free of cracks and cold shuts and has a fillet at the root of the tenon, at the shoulder, to prevent the formation of stress risers

Tongs: Must grab the intended stock firmly. Jaws of a suitable thickness for the job/size in hand, jaws to finish in the boss and not out-in-front of the boss, reins taper (already defined above) from the boss in both directions and match in length and cross section along their length. Boss or hinge plates to be of equal size and shape. It is not necessary that the reins/jaws open past 90 degrees so longs as they open sufficiently to allow the work to be grasped easily. The jaws should be of equal length and thickness where appropriate.
Reins should be of a size and shape to allow some spring, but not bend, when holding the work during forging.

Struck tools: The sides of the eye should be of a sufficient thickness to resist the blows of the smith or striker.

Electric or gas welding: Some projects or tooling will require the use of a gas or electric weld. It is desirable that these welds be smooth and inclusion free, but it is beyond the prevue of this curriculum to monitor such things.

Heat Treatment: Tools are to be heat treated where appropriate.

Level 1 *(0 - 24 hours) Getting Started*

Day #	1 – 4 hours	Intended outcome	4 – 8 hours	Intended outcome
1	Safety Nomenclature of the forge & anvil Types of hammer & hammer blows Fire management Drawing tapers	Student safety. Teach safety protocols. Develop a common vocabulary with the forge environment Develop a basic understanding of the typical hammers used in a forge and the type of blows used (full faced, half faced, fullering and shearing) Student should be able to start, tend and close down a fire safely (regardless of fuel used) Student should understand how and where to hold material on the anvil to draw down several tapers. The square, octagon, round rule (SOR) should be understood Tapers are to be a fixed length, straight sided with the ends centered along the center-line of the parent bar.	Forge a leaf (project) Forge a hot chisel. Tool to be annealed or normalized for future dressing and heat treatment If time allows, a second chisel should be forged and finished to a butcher edge	Student should understand how to 'neck-in' away from the end of a bar and spread material using a hand hammer. The effects of using the cross peen, ball peen and the flat face of the hammer for spreading should be understood by the student Student to understand the parameters associated with forging a hardenable steel. At the end of this section a student should possess the rudiment knowledge of: -Annealing -Normalizing -Hardening -Tempering
2	Forge a round ended, hand-held, punch Forge an oval section drift from round stock.	Student to demonstrate the knowledge of SOR and how progressing through the stages effects the length of the taper Student to understand the properties of a drift – taper to both working & struck end, with no corners of the taper proud of the main body of the drift	Slot punch or Slitting chisel Heat treat tools	Student to forge a slot punch or slitting chisel (instructors discretion) for use with the oval sectioned drift. Student should understand how slot punches/slitting chisels are related in size to the intended drifted and possibly forged outcome Student to heat treat and test hand tools from day 1 &2
3	Monkey tool for shouldering tenons Forge welding (Project)	Tool to have vent/visual hole punched and drifted using tools from day 2. Punching and drifting the eye is a pre-curser to making a leafing hammer. The hole shall be centered in the bar and perpendicular to the center-line of the parent bar Students should practice and demonstrate some competency of the	Tenon	Student to be able to cut, forge and monkey a tenon without forming cracks or cold shuts on the tenon or shoulder. A fillet at the tenon root is expected on the finished tenon.

		basic ‘faggot’ weld		

Level 2 *(24 – 48 hours) How metal moves, Square corners*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended outcome
1	Safety Ring project • Student will forge a welded ring out of flat bar-stock, bending on edge • The ring will be forge-welded shut	Review safety protocols Student will understand the behavior of steel when it is bent such as: -**Compression** (and subsequent thickening of the material) on the inside of the bend and **-Tension** (and subsequent thinning of the material) on the outside of the bend. Student s should learn to compensate for the 'movement' of the corners, at the end of the bar that accompanies forming a ring. Student will learn to upset at the end of the bar in preparation for welding. Student will understand the need for shaping a scarf at the end of the bar and forge a welding scarf. Student will learn to use the horn for bending and truing a ring without changing the cross section of the material other than compression and tension The ring should be forged to a pre-determined size.	Scrolling fork: Forged from one piece Mild steel case hardened or tool steel heat treated	Student must demonstrate that ability to properly allot stock for a given procedure – in this case, two tines of a scrolling fork together with a fixed gap on one end and a turned eye, of a fixed diameter, on the end of the handle Volume, area or weight calculations should be shown to assist in allotting the material to form the fork tines and gap. An explanation of forging a square corner by thinning one arm of the corner using a fuller or the edge of the anvil and drawing the arm down will be given as an introduction to forging or forming square corners
2	Scrolling jig (free-hand) • Student will forge a scrolling jig from flat bar-stock. • The jig will have a flared end for the start of the scroll • The jig can be flat or spiraled	Student will scroll the jig free-hand at the anvil using a hand hammer and scrolling fork with horns as needed. Student will observe the dishing associated with bending flat stock the 'easy' way and will compensate for the fact through filing or prior dishing the material. Jig can be either in a flat or spiral plane	'C' clamps Forged square corners using a pre-upset before bending Student will forge two square corners with round inside corners to form a 'C' shape The 'C' will be drilled and tapped to accept a threaded bar A wing-nut will be forged from bar-stock this can be welded to the threaded bar to form a clamp screw or riveted on using a square tenon on the screw.	Students will learn to upset in the middle of a bar – controlling the heat and length of upset. The upset should be reasonably centered in the bar prior to bending and forming the corners. Care should be taken to ensure that any upset is not drawn down during the forming of the corner. Students will learn how to control the bar when forging a square corner Corner will be free from any cracks and will be the same dimensions as the parent stock on either side of the square corner. The

				curved gusset should be of a constant radius.
3	Student shall forge and form a rectangular frame for fitting scrolls within. The frame should be made from heavy flat stock It is suggested that students will make a rectangular frame consisting of two 'L' shaped elements The 'L' shape will have an *upset* square corner at the corner of the 'L' with a tenon on one end with a punched round hole on the other end	Students will forge an upset square corner fee from cracks. The corner can be upset either pre or post bending. The tenons will fit into the punched holes on the other arm Tenons can be cut using a guillotine type of tool or a hand held fuller/chisel This frame will be used in the next level for fitting and collaring forged scrolls.	Students shall form/forge two upset corners that are close enough together to provide the student with experience that will assist them later in the final grille.	

Level 3 *(48 – 72 hours) Scrollwork & collars*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Scrolls • Ribbon scroll • Fish tail & knib ended scroll	Review safety protocols Student will become somewhat proficient at forging various scroll ends. An emphasis will be placed on the student to form (at least the start) the scroll freeform using a hand hammer adding scrolling fork and horns as necessary. Scrolls will be free from straight sections and kinks along the length of the formed scroll. A scroll form can be used if required provided that the student made the scroll form.	Scrolls • Bolt ended scroll • Snub ended scrolls: 1. Half penny scroll 2. Snub end scroll	Student will note that a scrolling jig will have to be purpose built to accommodate the bolt and snubbed scroll ends
2	Scrolls • Beveled scrolls • Beveled leaf scrolls	Student will learn to turn beveled scrolls at the anvil. The student will understand how to turn left and right facing scrolls.	Collars Collar mandrel or tongs	Student will understand the attributes of a collar mandrel or collaring tongs. Such as tapered end to allow for easier collar removal. Student will understand the basic formula for determining the length of stock needed for a collar and be able to manipulate that information as the stock cross section changes. Such as the center collar in the final grille project. Test collars are to be encouraged. Student will forge collars over a mandrel to achieve square corners on both the inside and outside corners
3	Fitting and collaring scrolls in frame	Students will fit two 'S' shaped scrolls back to back within the frame completed in level 2. The scrolls will be collared where they touch each other with a square-cornered collar. An example of each type of scroll		

		should be included in the mix: • Beveled • Snubbed • Ribbon or fishtail		

Level 4 *(72 – 96 hours) Leaf work and tooling*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Crimping stake Scroll starter *Tools made for this level should be geared towards making the water leaves needed in the final grille project.*	Review safety protocols Student will forge a crimping stake to fit their anvil hardy hole (where practical). Stake should offer enough clearance for crimping water leaves The hardy stops can be made as a fold or as a welded collar	Hammer eye drift Slot punch/slitting chisel of the correct size if not already completed in level one.	Forge a drift(s) that have the correct degree of taper to be used to fit hammer handles provided. The drift should reflect the correct width to thickness ratio as the hammer handle used
2	General purpose leafing hammer	The student should forge a general-purpose leafing hammer that is to be used either at the anvil or at the vice (straight or curved body) The cross peen shall match the fullered groove of the crimping stake with an allowance for the thickness of the leafing material (approx 1/16 inch)	Leafing stakes to curl water leaves	Student will understand the use and design of a leafing stake. The student will understand that the stake can be too narrow in angle causing the leaf edges to curl over and form a pipe like form. Stake can be fabricated as needed.
3	Water leaves: • Appliqué • Forged and formed from the same bar as the scroll end.	Two methods of forging water-leaves should be used in this section. The first shall show an 'Appliqué' method of application with a box weld completed over a section of bar that contains a scroll on the end. The second leaf shall be made by spreading a bar on the other end from which a beveled leaf scroll has been made. The bar shall be cut and folded back upon itself, then welding the joint closed. Both sets of bars should be further welded on to another bar that will form the remainder of the scroll		

Level 5 *(96 – 120 hours) Anvil tooling and bench-work (welded collars)*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Create three cold chisels • Gouge • Cape • Diamond All for surface work	Review safety protocols. Student will be made aware of some types of cold chisels and their usage. An explanation of the orientation of the cutting edge of the chisel when compared to the centerline of the tool will be given. The student will understand the difference between surface and deep work chisels e.g., the gouge being used to cut oil channels in concave bearing shells	File and heat-treat chisels Drill a large hole in a thick (e.g. 3/4-inch) section of plate steel to match the hardy hole size and use the three chisels to 'cut' in the corners to convert the drill hole into a square hole slightly larger than the students anvil hardy hole Drill and cut an second plate to 1 3/8 square hole for use in making top tools	Student will be exposed to cutting metal (stock removal) using hand tools – in this case cold chisels. The student will be encouraged to use a file(s) such as a three square file to clean up the square hole giving the instructor an opportunity to talk about types of file and filing techniques. This information will be useful in a later level when making the hinge journal on a small gate. It is intended that the heavy plate with the square holes will be used to make top and bottom tools needed later in the grille project. The plate may be welded to heavy wall tubing to form a heading block.
2	Student will fabricate a small swage block for use in making top and bottom tooling for the anvil.	Student will produce a portable swage block for use in making top and bottom tools. The swage block will have a re-enforced center that does not interfere with the use of the tool. The swage block should be constructed to allow for it to be used on the face of the anvil, over the main body, without danger of it falling off and causing injury. The swage block needs to be able to be turned over to access both square holes.	Create one bottom swage & one top tool blank. Forge the tooling required by the instructor to let in the shapes needed to use the tools for welding on the collars needed in the center bar of the final grille project.	This hand held fuller will be used on the top and bottom swage blanks to create a matched pair of tools for use in creating a welded collar. The collar should be in the region of ½ inch wide and have an OD of about 1 inch±. These tools will be used later in the ABANA grill project. The top tool can be punched to accommodate a handle or rodded. Both swages will be case-hardened if made from mild steel or heat treated if made from a hardenable steel.
3	Create welded collar on rectangular stock This is a practice session for welding collars onto flat bar	A section of ½ inch wide and ¼ inch thick half-round bar will be welded to a section of 3/8 by 1 inch flat bar. The flat bar will be necked in somewhere along its length to create a		

	such as those used in the final grille project.	round section of bar around which the collar will be welded. The student should be able to identify problems associated with applying and trying to weld both too much and too little collaring stock. The collars should be firmly welded without gaps at the edges or join.		

Level 6 *(120 – 144 hours) Small scale joinery Pass throughs*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Square drift x 2 Round drift x 2 Diamond drift x 2 Bolster plates/swages	Review safety protocols Student will understand the manufacture and use of a drift in making holes of a given size and shape Drift will be oversize to allow for the shrinkage of the parent bar during cooling. The student will create bolster plates or swages to support the stock during drifting over the hardy hole, pritchel hole or the vise. The bolsters will be punched and drifted to allow a clearance fit of the primary drift.	Punch and drift test bars Pass throughs Thru square bar Thru round bar Thru flat bar	Student will understand the relationship between the tool used to create the initial hole and the primary drift. Student should understand the different approaches to achieving a given sized hole in a bar and how they affect the physical size and look of the sides of the eye: • Punch and drift • Punch, upset and drift • Upset, punch and drift Student should understand how to determine bar stretch or shrinkage and how to allow for such factors during layout.
2	Fabricate or forge a bolster plate to support material for and angled pass through The bolster should be for use in the vice and allow clearance of the primary drift Pierced and drifted material can be either round or square stock. Square stock will be punched and drifted on the flat at this stage	Student will understand the maximum angle that can be attained using a given procedure.	Angled pass throughs Round bar and square bar	Student to become practiced in angled pass throughs of both round and square stock. The student should understand the limits of any techniques used The student should be encouraged to produce pass throughs that show drifting from punching and drifting an upset bar to show an increase in the sides of the eye material.
3	Create a 'V' shaped bolster swage for use in both perpendicular & angled pass thoughs of square bar across the corners		Perpendicular and angled pass through of square bar across the corners - test pieces	

Level 7 *(144 – 168 hours) Large scale joinery*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Heel tenon monkey tool or side set Eye drift Slot punch/slitting chisel	Review safety protocols Student should be able to produce both square and oval monkey tools for use in dressing tenon shoulders. Student to make a dedicated set of tools for use with the monkey tool to ensure a precision fit of the tenon into the punched and drifted eye.	The heel tenon	Student should produce a heel-tenon of sufficient size to support a small pedestrian gate or sign bracket. Student should understand the forces of Tension and Compression and how the heel-tenon counters these forces. The heel-tenon can be either: • Upset and then cut to form the tenon or • Forge welded to increase the mass at the bar end and then cut to form the tenon.
2	Hinge style on small pedestrian gate Punched and drifted eye to match heel tenon Upper hinge journal cut, chiseled and filed to round Strap and bar to finish the hinge Lower hinge to be either a tenon on the bottom of the hinge style or a peg (tenon) fitted to a ground plate. The hinge style can be drilled or punched to accommodate the peg	Upper hinge journal shall be round Securing strap shall be straight sided showing some preparation of the bar prior to bending Lower hinge must be stepped to the ground and be adjustable. The hinge style can either have a female or a male end, but the ground section needs to be included	Square & rectangular blockings Square drift Rectangular drift Slot punch or Slitting chisel	Student will understand the relationship between the size of the initial slot/slit chisel and the intended drift. Student will upset the slot/slit cut hole prior to drifting. The drifts will be made so that they can be re-orientated in the upset hole once placed. Student will perform a test piece and record the changes in length of the bar. A layout of a number of holes should be performed, showing an understanding of how to accommodate for and change in bar length
3	Round, square & rectangular tenons on rectangular bar such as the top and bottom rails	The student must demonstrate the ability to cut and forge various shaped tenons on rectangular barstock. The tenons should be formed in such a way that the student can demonstrate that the shoulder is in a previously described position on the bar	Punched holes Round holes in bar Square holes in bar.	Student must demonstrate the ability to punch both round and square holes in a moderately heavy section of flat bar-stock. The holes need to be at a prescribed distance apart to allow the student to demonstrate the ability to compensate for the stretch of the bar-stock. The square holes can be punched with a square punch or punched round and drifted square.

Level 8 *(168 – 192 hours) Repousse*

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety Student will make repousse stakes sufficient in number to produce a small Acanthus leaf of a classic design	Review safety protocols Student will understand the relationship between the width and crown of a tool end and the degree of curve that it can be made with it. Student will understand the relationship between the thickness and dressing of a tool end and the width of the vein that can be raised with it. Tooling will be made to shape the lobes of the leaf ends The tooling can be either anvil or vice appropriate	Student will make a repousse hammer(s) to accompany the repousse stakes using methods and tooling learned in level 4.	The hammer shape should reflect the intended area of use, either at the anvil or at the vice. One end of the hammer must be suitable for 'cleaning' up diverging/converging veins
2	Forge/form an Acanthus leaf of a classic design	Student will forge & form an Acanthus leaf of a classic design from ferrous material. The material shall be no thinner than 1/16th of an inch thick A veining tool or hand held fuller can be used to start the veining process. The veins, piping and eyes will be finished over the repousse stakes.	Student will forge a basic set of hand-held repousse tools such as: HB issue vol &#	
3	exercises		exercises	

ABANA Grill project (a culmination of previously taught skills) Typically a 2 week class.

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Safety	Student will use tools and skills learned previously in the National curriculum to produce the grill project.		
2				
3				
4				
5				

Tong making

Day #	1 – 4 hours	Intended Outcome	4 – 8 hours	Intended Outcome
1	Scrolling tongs	Student to forge and assemble a pair of tongs for use on a future project. Forge welded reins are an option but not required Hole to be punched using tools from day 2 Rivet to be a tenon made from bar-stock	Flat or open jaw tongs requiring forge-welded reins	Student should forge the jaws of a pair of flat or open jaw tongs from square bar-stock The reins should be forge-welded into place Student should complete a multiple piece lap weld (drop tong weld).
2	Box Jaw tongs	Student should forge the jaws of a pair of box-jaw tongs from square bar-stock The reins should be forge-welded into place Student should complete a multiple piece lap weld (drop tong weld).	90 degree flat or open jaw tongs	Student should forge the jaws of a pair of flat-jaw tongs with a 90 degree horizontal bend from square bar-stock The reins should be forge-welded into place Student should complete a multiple piece lap weld (drop tong weld). The upper jaw can be either diamond bit or half round to accommodate holding a leaf onto a bar for forge-welding purposes.
3	Bolt-jaw tongs	Student should forge the jaws of a pair of bolt-jaw tongs from square bar-stock The reins should be forge-welded into place Student should complete a multiple piece lap weld (drop tong weld). The jaws can be either diamond bit or half round.		
4				
5				