Definitions and equations

ICL The distance the crank has moved after TDC when the intake valve is at max lift
If intake CL is larger than the LSA cam is retarded

Advance =LSA-
ICL
LSA = (intake Cl+ExCL)/2

Intake Opening

- Critical to
  - Vacuum
  - throttle response
  - emissions
  - gas mileage
- Late opening
  - smooth idle and low RPM operation adequate manifold vacuum
- Early opening
  - Better fill at high RPMs
  - Better purging of the cylinder
  - Worse gas mileage due to scavenging the intake charge through the cylinder

Intake Closing

- More effect than any other valve opening or closing point
- Early closing
  - More cranking pressure
  - Critical to low engine torque
  - Reduces emissions
  - Improves fuel economy

- Late closing
  - Improves filling at high RPMs
  - Can cause reversion if too late
- Optimum
  - Closes valve just as air stops flowing
  - Seats valve quickly
  - Slow enough to protect valve bounce

Exhaust valve closing

- Similar to opening the intake early
- Early closing
  - Smoother operating engine
  - Doesn't necessarily hurt top end if combined with later intake valve opening
- Late closing
  - increased valve overlap
    - Reversion
    - Intake mixture going out exhaust
    - Purges the cylinder at high RPMs
    - Provide a better vacuum signal at high RPMs
    - Increases the usable RPM range (My observation)

Lobe Centerline

- Advancing the Cam
  - Cams usually ground 4 degrees advanced so stock timing gears can be used to obtain the advance
  - Moves intake and exhaust an equal amount
    - Results in earlier timing events
    - Engines usually respond better to advance
      - Probably due to intake closing point being earlier?

LDA

- Ground into cam
  - Cannot be changed
- Narrow LDAs

increase mid range torque
Results in faster revving

Wide LDAs
Wider power band
lazier response
Smoother idle
higher vacuum

Dual plane manifolds like 110-112 LDA

Fuel injected like 112 to 114

Duration

Higher durations increase top end at the expense of low end

.050 considered the norm when considering duration

Cars with less than 10.25 compression, headers and an intake like 215- to 230 duration hydraulic cams or 230 to 240 mechanical

Aggressive profile
better vacuum
increased responsiveness
broader torque range
increased drivability

Engines with significant airflow or compression limitations like aggressive profiles
Gets the charge through the restriction with a higher (vacuum?) signal

Long durations
Reduce cylinder pressure so higher compression can be used
Sluggish below about 3000 RPMs

Lift

Short duration high lift
Excellent throttle response
Great torque
good power

Less dependable (prone to cam wear)
need the right springs
need heads and manifold to support the higher flows
Rockers increase lift, but the valve train may become unstable -start from ground up

Overlap

Lift duration and LDA define the overlap triangle
increasing LDA decreases overlap
More Overlap
Decreases low rpm vacuum
increases mid range vacuum
provides a better filling of cylinder
noticeable acceleration improvement

Less Overlap
increases fuel economy
improves low end response
less reversion
Better idle
stronger vacuum

Visnard

Most important valve/cam event
Should be positioned around TDC
Need to get intake started well before piston effects.
My thought is advance moves the center of the triangle to the BTDC side
Developing overlap area with lift instead of duration is preferable
engine combos are sensitive to overlap
due to intake
exhaust efficiency
head flow with valves slightly open

Asymmetrics

Tailor lobe for the shortest seat timing and highest lift within the limits of the valve train
Cam can be tailored to the heads

Some heads need faster or slower valve openings

Closing velocities must be kept below a certain threshold for quiet operation

Almost all modern cans are asymmetric