

Intelligent Compaction

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Intelligent Compaction for Hot Mix Asphalt

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IC for HMA

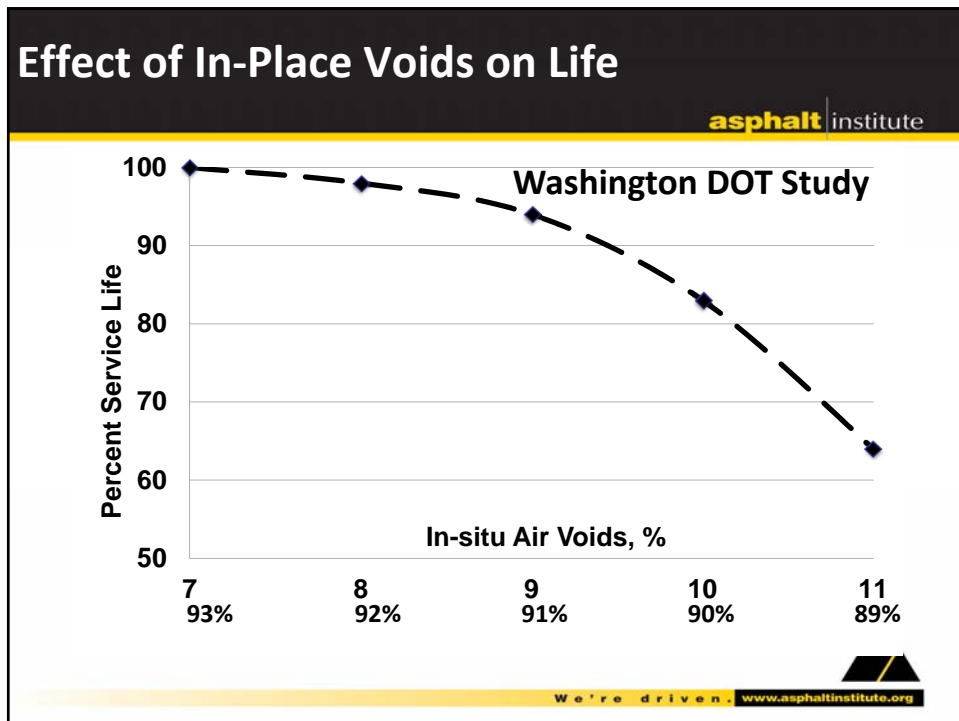
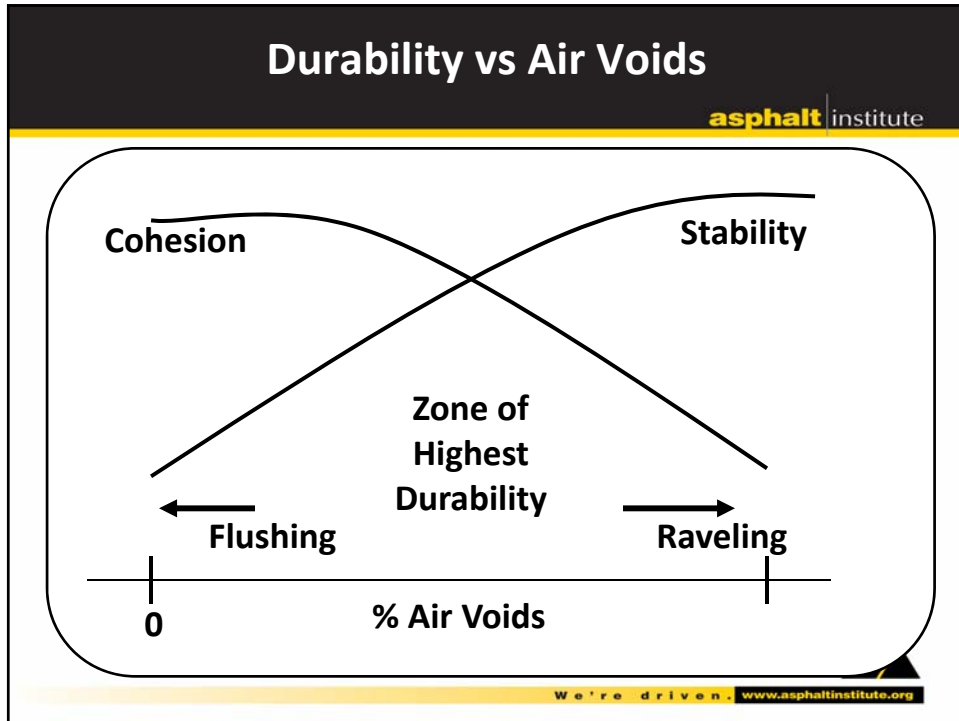
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- Outline
 - Why do we need Intelligent Compaction?
 - What is Intelligent Compaction?
 - How does IC work?
 - What are the benefits?
 - National research efforts

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Intelligent Compaction



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Factors Affecting Compaction

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- Mix Properties
 - Aggregate
 - Asphalt
 - Air (Volumetrics)
 - Mix Temperature
- Lift Thickness
- Subgrade & Base Support
- Environmental Factors
- Type and Size of Roller, # of Passes



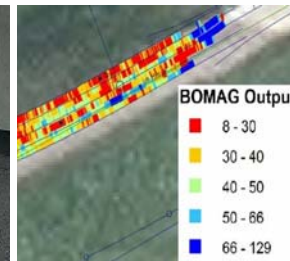
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What is Intelligent Compaction (IC)?

An Innovation in
Compaction Control



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Why Do We Need IC?

- Proper in-place density is vital for good performance
- Conventional compaction equipment and procedures have shortcomings and too often produce poor results
- **Intelligent compaction technology appears to offer “a better way”**



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Conventional Shortcomings

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- The Compaction Process...



Limited “On The Fly”
Feedback



Over or Under
Compaction Can Occur



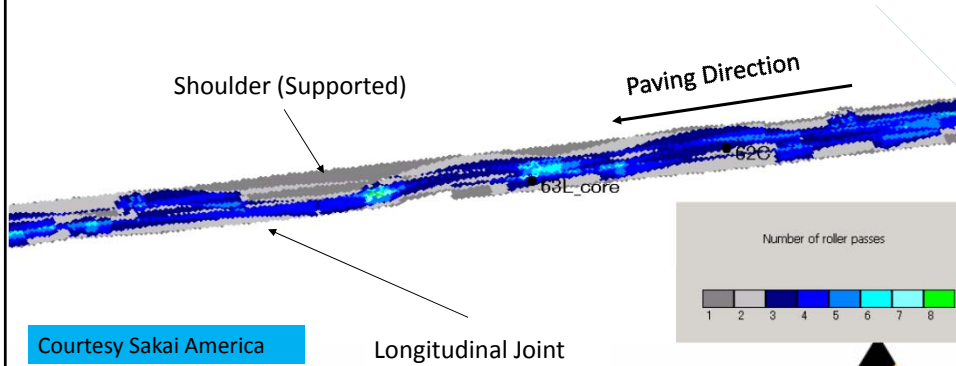
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Sakai IC Roller Project

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- Roller Passes



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What is Intelligent Compaction?



Single Drum Soils Roller



Tandem Drum Asphalt Roller

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Available Tandem Drum IC Rollers

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Bomag



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Global Positioning System (GPS)

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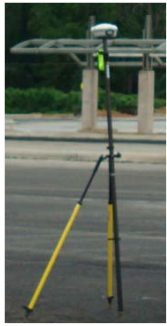
GPS Base Station



GPS Radio & Receiver



GPS Rover



Real Time Kinematic (RTK) GPS Precision

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“A system of hardware, software and analysis equipment installed on a roller that work together to improve the compaction process”



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IC Roller Requirements

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- IC Roller Requirements
 - Roller Measurement Value (RMV)
 - GPS-Based documentation system
 - Color-coded display (on-board)
 - Surface temperature measurement system

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- How does an IC roller work?
 - GPS tracks roller position and matches with RMV, mat temperature, # roller passes
 - Color-coded mapping capabilities
 - Vibratory rollers
 - Accelerometers on drum measure materials response to vibratory impulses



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- How does an IC roller work? (cont.)
 - On-board computer calculates and stores roller measurement value (RMV)
 - RMV is displayed to the roller operator continuously during compaction process
 - Feedback control system automatically adjusts roller parameters (amplitude) to optimize compaction

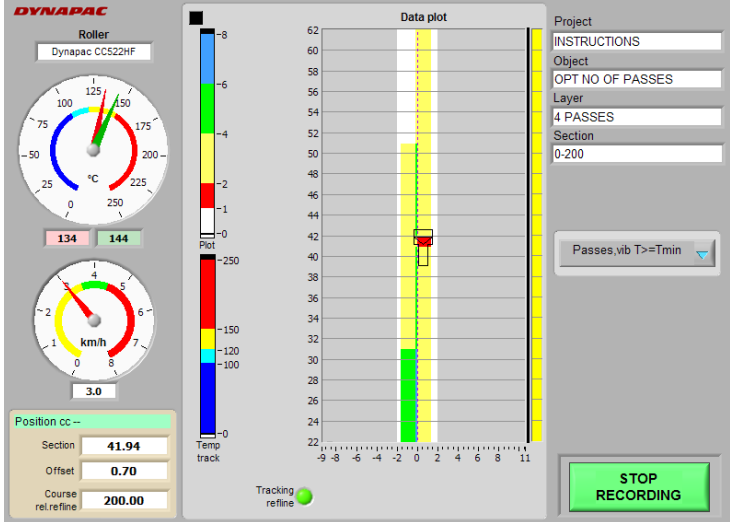


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Dynapac On-Board Display





Roller
Dynapac CC522HF

Temperature: 134 °C
Speed: 144 km/h

Position cc --
Section: 41.94
Offset: 0.70
Course rel.refine: 200.00

Data plot


Project: INSTRUCTIONS
Object: OPT NO OF PASSES
Layer: 4 PASSES
Section: 0-200

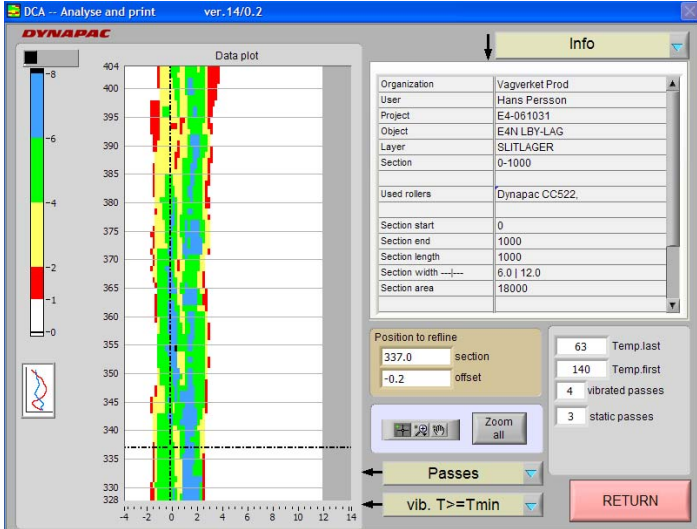
Passes,vib T>=Tmin

STOP RECORDING

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Dynapac On-Board Display





DCA -- Analyse and print ver.14/0.2

DYNAPAC

Data plot

Info

Organization: Vagverket Prod
User: Hans Persson
Project: E4-061031
Object: E4N LBY-LAG
Layer: SLITLAGER
Section: 0-1000

Used rollers: Dynapac CC522

Section start: 0
Section end: 1000
Section length: 1000
Section width: 6.0 | 12.0
Section area: 18000

Position to refine:
337.0 section
-0.2 offset

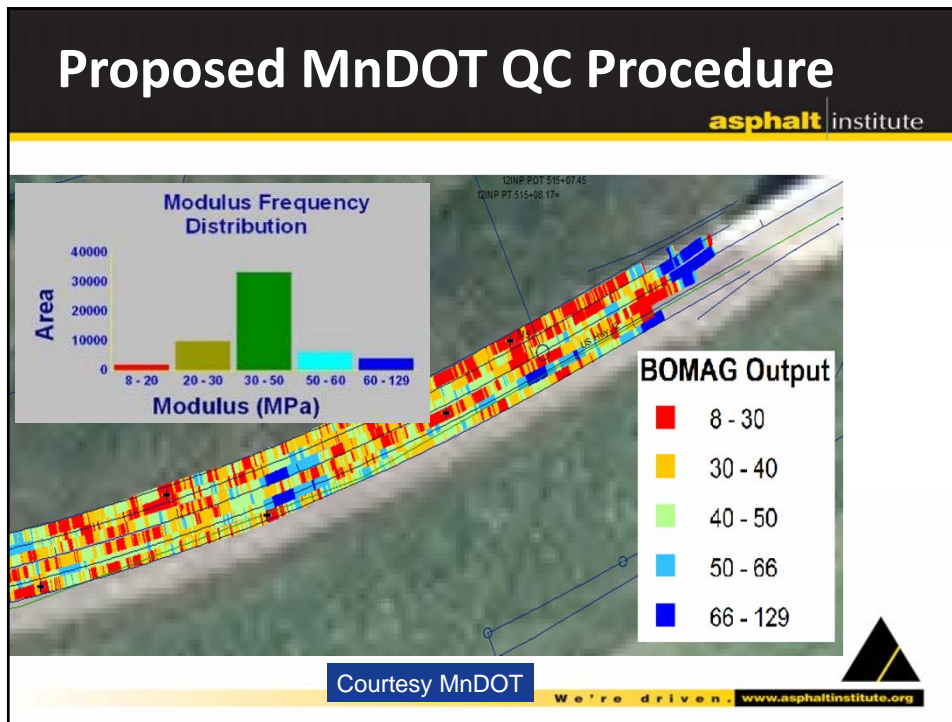
63 Temp.last
140 Temp.first
4 vibrated passes
3 static passes

Passes: [dropdown]
vib. T>=Tmin [dropdown]

RETURN

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Benefits of IC for HMA

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- Improved density....better performance
- Improved efficiency....cost savings
- Increased information...better QC/QA
- Overall Benefit:
Improved Pavement Performance!

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“Mapping” of Underlying Materials

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- Use of RMV color-coded mapping to measure support prior to paving of:
 - Subgrade soil materials
 - Stabilized subbase materials
 - Aggregate base materials
 - Existing asphalt pavements
 - Rubblized concrete pavements
- Underlying Support affects compatibility of subsequent layers



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“Mapping” of underlying layers

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Mapping of the subgrade / agg. base layer



Minnesota ICPF Project www.asphaltinstitute.org

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WI ICPF Project

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Rubblized PCC base

Crack-and-seat PCC base

shoulder

shoulder

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IC Research

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Transportation Pooled Fund 954
*Accelerated Implementation of
Intelligent Compaction Technology for
Embankment Subgrade Soils,
Aggregate Base, and Asphalt
Pavement Materials*

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Purposes of ICPF

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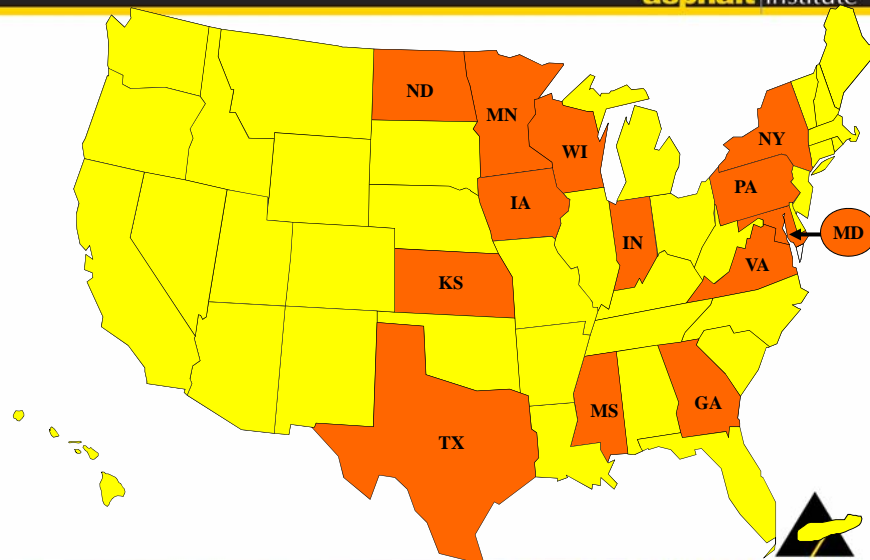
- Accelerate the development of IC QC/QA specifications for subgrade soil, aggregate base and asphalt pavement materials
- Develop a knowledgeable group of experts in the use of IC technology
- Identify needed improvements in IC technology and in companion in-situ tests



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Accelerated Implementation of IC

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Roller Operator Training

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The image shows two construction workers in safety gear (hard hats and high-visibility vests) operating a roller machine. One worker is seated at the controls, while the other stands beside him, possibly providing instruction or assistance. The machine is a large, yellow and black roller, likely used for compacting asphalt. The background shows a construction site with trees.

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Special Issues for IC on HMA

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- Thin lift construction
- Allowable temperature ranges to eliminate binder viscosity stiffening
- Surface vs. internal mat temperature measurement
- Non-destructive, in-situ stiffness / modulus companion tests

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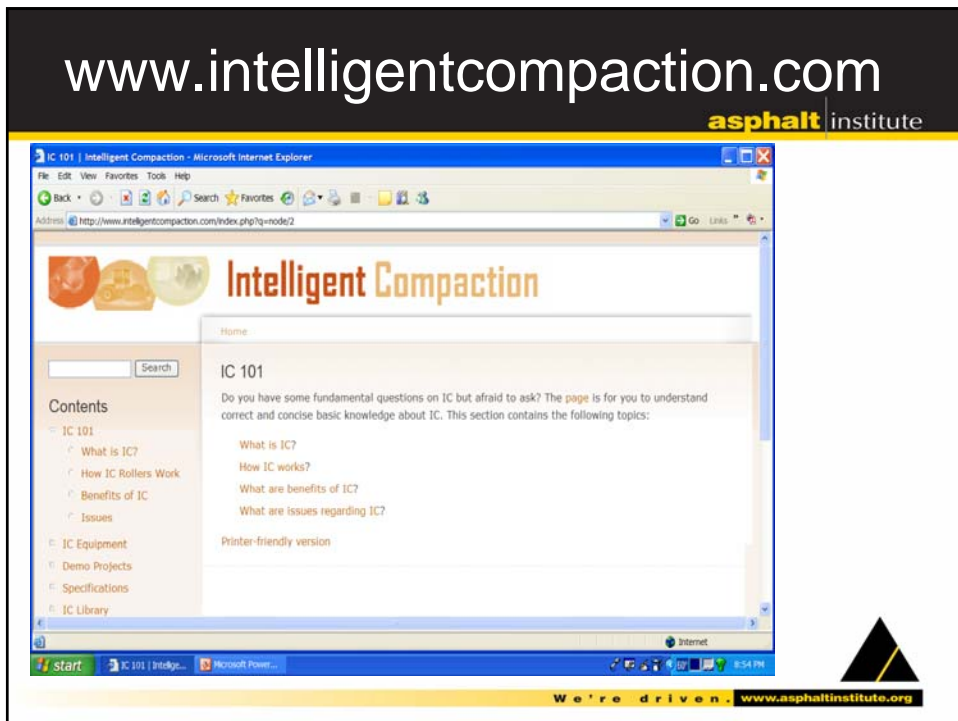
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What have we learned so far?

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- IC technology has tremendous potential to improve the compaction process
- Improved and more uniform density should result in increase pavement service life
- IC technology can provide valuable tools for QC and eventually possibly QA



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What have we learned so far?

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- There is a great deal of interest among FHWA and state DOTs
- Roller manufacturers are responding to this interest by performing R&D, providing rollers and by coordinate efforts with state and national research efforts
- Preliminary findings from studies in US are encouraging



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Summary

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- Intelligent Compaction is a major innovation in compaction technology
- Research/field projects show that IC can offer a valuable tool to improve QC of the compaction process
- IC technology is now readily available in U.S. and coming into Canada
- More work is need to address various issues
- Stay tuned!

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We've Come a Long Way

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1924 Buffalo Springfield Steam Roller

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