

Bond University
Research Repository



Occupational Load Carriage for Tactical Populations: Green, Blue and Red

Orr, Rob Marc

Licence:
CC BY-NC-ND

[Link to output in Bond University research repository.](#)

Recommended citation(APA):

Orr, R. M. (2018). *Occupational Load Carriage for Tactical Populations: Green, Blue and Red*. Tactical Strength and Conditioning Conference, Virginia, United States.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

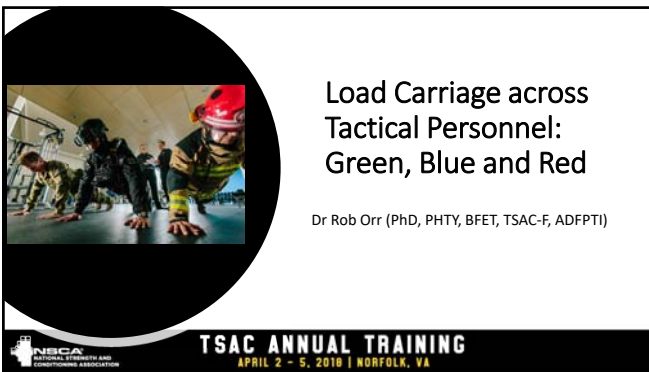
For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.



TSAC
TACTICAL STRENGTH AND CONDITIONING
ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA
NSCA.COM/TSAC2018
2.0 CEUs

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

FIT TO SERVE. STRENGTH TO PERFORM.



Load Carriage across Tactical Personnel: Green, Blue and Red

Dr Rob Orr (PhD, PHTY, BFET, TSAC-F, ADFPTI)

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

Conflict of Interest Statement

- I have no actual or potential conflict of interest in relation to this presentation.

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA








Content

- Military
- Law Enforcement
- Fire and Rescue
- Injuries
- Impacts
- Conditioning




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

HISTORICAL CONTEXT – MILITARY

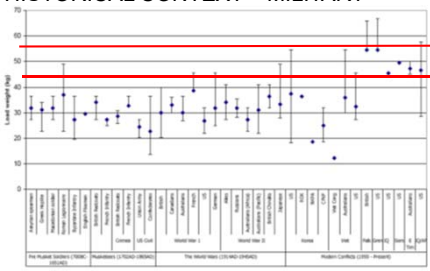
Background

- From the early Assyrian spearman of antiquity (circa 800 B.C.), soldiers have been required to carry external loads consisting of weaponry, equipment and food
(Orr, 2010; Knapik et al., 2012:2004)
- Downstream effects of these loads have been shown to impact on the tactics of warfare, cause injury and reduce fighting force size
(Lee, 2007; Breen, 2002; Lothian, 1921)




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA


HISTORICAL CONTEXT – MILITARY



(Orr, 2010: Orr et al., 2015)



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




CURRENT CONTEXT – AUSTRALIAN ARMY

On Operations (2001-2010)

- PO loads
 - $M=28.4 \pm 10.0$ kg
 - heaviest mean load in 2008 ($M=36.9 \pm 10.8$ kg)
- MO loads
 - $M=56.7 \pm 15.3$ kg
 - heaviest mean load in 2009 ($M=65.1 \pm 16.3$ kg)
- OVERALL loads
 - 47.7 ± 21.0 kg, (mean range over 10 years = 40.7 kg to 50.9 kg) *(Orr et al., 2015).*

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA





CURRENT CONTEXT – AUSTRALIAN ARMY


- Approximate relative load carried by Roman Legionnaires = 56%
- Australian Soldiers in East Timor = 56%
- US Soldiers in Afghanistan = 57%




(Orr et al., 2010)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






ABSOLUTE VS RELATIVE LOADS


- Currently female soldiers carry lighter absolute loads than male soldiers but only slightly heavier relative loads

<u>ABSOLUTE LOADS:</u>	<u>RELATIVE LOADS</u>
FEMALE: $M = 26.4$ kg	FEMALE: $M = 43\%$
MALE: $M = 39.0$ kg	MALE: $M = 47\%$
<u>p=.045</u>	<u>p=.55</u>

(Orr et al., 2015)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






ABSOLUTE VS RELATIVE LOADS

- Currently lighter soldiers carry the same absolute loads as heavier soldiers but heavier relative loads

<u>ABSOLUTE LOADS</u>	<u>RELATIVE LOADS</u>
Light 20%: $M = 34.7$ kg	Light 20%: $M = 49\%$
Heavy 20%: $M = 35.7$ kg	Heavy 20%: $M = 36\%$
$p = .902$	$p = .0509$

(Orr et al., 2015)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA





HISTORICAL CONTEXT – LEO



<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA





HISTORICAL CONTEXT – LEO


- Police are becoming Christmas trees



<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>
<http://imgur.com/a/2006550410062ubd0fjg>


TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






HISTORICAL CONTEXT - LEO

- Increasing levels of threat



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




CURRENT CONTEXT – AUSTRALIAN LEO

ILAV type (A-C) & Normal station wear (N)	ILAV Weight (kg)	Duty load Complete (kg)	Total load including officer weight (kg)
A	4.12 ± 0.65*	11.53 ± 0.77‡	88.03 ± 20.49
B	3.54 ± 0.70*	11.01 ± 1.01‡	87.51 ± 20.60
C	3.24 ± 0.48*	10.77 ± 1.16‡	87.27 ± 20.66
N	NA	8.69 ± 0.68	85.19 ± 20.24

* Significantly different (p<0.05) between vests; † Significantly different (p<0.001) from normal station wear (Orr et al., 2016)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA



CURRENT CONTEXT – AUSTRALIAN LEO

ILAV type	FEMALE		MALE	
	ILAV + Duty Loads (kg)	ILAV + Duty Loads (kg)	%BW	%BW
A	11.14	11.85	16.90	14.90
B	10.80	11.18	16.43	13.91
C	10.24	11.22	15.60	13.95
N	8.68	8.70	13.20	10.92

*p=0.225 †p=0.009 (Orr et al., 2016)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA



CURRENT CONTEXT – US LEO


	COMBINED (n=246)
Age (yrs)	30.82±5.84
Years sworn (yrs)	3.62±3.46
Body Wt (Kg)	85.69±15.08
Load Wt (Kg)	10.72±1.73
Relative load (%)	11.83±2.38



(Dulla et al., 2017)




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




CURRENT CONTEXT – US LEO

	FEMALE (n=43)	MALE (n=203)
Age (yrs)	30.60±4.56	30.86±6.09
Years sworn (yrs)	4.03±2.92	3.54±3.56
Body Wt (Kg)	68.78±10.96*	89.27±13.31
Load Wt (Kg)	9.99±1.66*	10.87±1.71
Relative load (%)	13.36±2.46*	11.50±2.24

* Significantly different from male sheriffs, p<.001 (Dulla et al., 2017)




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




CURRENT CONTEXT – US LEO (2) (Dawes, Kornhauser, Holmes, et al., submitted)

	Cohort Mean ± SD (Range)	Male Mean ± SD (Range)	Female Mean ± SD (Range)
Age (years)	38.79 ± 7.97 (22 – 66)	38.36 ± 8.06 (22-66)	40.88 ± 7.68 (25-50)
Height (cm)	177.45 ± 8.36 (156.21 – 195.58)	179.53 ± 6.95 (165.10 – 195.58)	167.32 ± 7.49 (156.21 – 177.80)
Weight (kg)	88.61 ± 19.44 (51.71 – 154.59)	91.35 ± 18.20 (66.04 – 154.58)	75.22 ± 20.95 (51.71 – 118.16)
Absolute load (kg)	9.57 ± .94 (7.08 – 12.02)	9.61 ± .97 (7.08 – 12.02)	9.34 ± .81 (8.26 – 10.70)
Relative load (% of body weight)	11.19 ± 2.14 (5.93 – 17.02)	10.82 ± 1.87 (5.93 – 14.56)	13.00 ± 2.56 (8.41 – 17.02)




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA



ABSOLUTE VS RELATIVE LOADS


- Both LEO studies found female officers carried either the same (AUST) or lighter (US) absolute loads compared to the male officers
- However when expressed as a percentage of their body weight female officers carried significantly more relative load than male officers

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




CURRENT CONTEXT – AUSTRALIAN LEO (TOU)

	Mean ± SD	Range
Absolute load carried (kg)	22.8 ± 1.8	20.6-25.6
Relative load carried (%BW)	25.9 ± 4.0	21.2-28.8



(Carbone et al., 2014; Carlton et al., 2014)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




HISTORICAL CONTEXT - FIREFIGHTING

1770 1879 2016



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




BOND UNIVERSITY
UNIVERSITY OF APPLIED SCIENCES


(Orr, Gorey et al., 2015)


CURRENT CONTEXT – AUST FIRE

	MEAN ± SD
Age (yrs)	34.14 ± 7.69
Years of Experience (yrs)	7.00 ± 8.18
Unloaded Weight (kg)	90.96 ± 9.65
Weight of Supervisor PPE (kg)	11.03 ± 0.10
Weight of Firefight PPE-FF (kg)	22.61 ± 0.31
Relative Weight of PPE (% body weight)	13.13 ± 0.05
Relative Weight of PPE-FF (% body weight)	22.23 ± 2.18



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






BOND UNIVERSITY
UNIVERSITY OF APPLIED SCIENCES

(Dawes et al., unpublished)

CURRENT CONTEXT – US FIRE




Position	Driver	Firefighter	Officer	Paramedic
Age (yrs)	41.89 ± 8.22	35.63 ± 8.67	49.85 ± 6.48	39.00 ± 10.24
Height (cm)	175.61 ± 8.73	178.17 ± 6.12	176.39 ± 4.86	178.16 ± 4.65
Weight (kgs)	93.01 ± 16.16	87.55 ± 12.17	90.50 ± 15.16	88.45 ± 10.35
BMI	30.15 ± 4.41	27.49 ± 3.17	28.59 ± 4.22	27.82 ± 2.74
PPE Load (kgs)	27.25 ± 6.27	27.99 ± 1.92	27.00 ± 2.01	28.02 ± 2.177
PPE Load (%bw)	30.49 ± 10.46	32.57 ± 4.99	30.40 ± 4.58	32.10 ± 4.67

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






19/02/16 05:42:49 85 °C








SEX DIFFERENCES IN LC INJURIES (Orr et al., 2016)

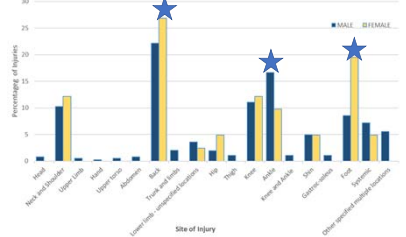
- Mean ARA population over 2 years = 24,876 personnel
 - Female n= 2441 (10%); Male n= 22435 (90%)
- 401 reported injuries associated with load carriage
 - Female n=40 (10%); male n= 361 (90%)
 - RR = 1.02 (95% CI 0.74 to 1.41)
- SPI
 - Female n=6 (15%); male n= 23 (6%)
 - RR of SPI = 2.40 (95% CI 0.98 to 5.88)






NSCA NATIONAL STRENGTH AND CONDITIONING ASSOCIATION
TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA

SEX DIFFERENCES IN LC INJURIES (Orr et al., 2016)




NSCA NATIONAL STRENGTH AND CONDITIONING ASSOCIATION
TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA

IMPACTS ON PERFORMANCE - MARKSMANSHIP

- Decrements in performance:
 - ↓ Marksmanship (Knapik et al., 1990;1991;1997; Rice et al., 1999).



NSCA NATIONAL STRENGTH AND CONDITIONING ASSOCIATION
TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA

BOND UNIVERSITY
NATIONAL RESEARCH UNIT

IMPACTS ON PERFORMANCE - MARKSMANSHIP

- **Reduced performance**
 - Survey of 218 soldiers on operations

(Orr et al., 2013)

Operational Task	Impact of Load Carriage on Performance
Mobility	-1.24
Marksmanship	-0.95
Grenade Throw	-0.99
Administration	-0.96
Attention to Task	-0.80

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

TSA

BOND UNIVERSITY
NATIONAL RESEARCH UNIT

IMPACTS ON PERFORMANCE - MARKSMANSHIP

- Distance to centre of target
 - DCOT
- Horizontal shot spread
 - X-Dispersion
- Vertical shot spread
 - Y-Dispersion

(Carbone et al., 2014)

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

TSA




TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

BOND UNIVERSITY
NATIONAL RESEARCH UNIT

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

TSA



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

IMPACTS ON PERFORMANCE - MARKSMANSHIP

- Marksmanship

(Carbone et al., 2014)























IMPACTS ON PERFORMANCE - MARKSMANSHIP

- No significant difference when TL

Task & Loading Condition	DCOT (mm)	X-Dispersion (mm)	Y-Dispersion (mm)
Table 1. Primary weapon marksmanship results from all four conditions			
Short Forward Movement			
Fatigues Only	75.93 ± 17.97	112.50 ± 31.25	143.58 ± 44.84
Tactically Loaded	70.48 ± 19.57	76.42 ± 46.95	148.42 ± 50.35
Mobility Task			
Fatigues Only	74.83 ± 36.95	136.67 ± 70.66	212.25 ± 129.64
Tactically Loaded	100.10 ± 20.14	112.50 ± 51.59	213.67 ± 70.99
Data are mean ± standard deviation			
Table 2. Secondary weapon marksmanship results from all four conditions			
Short Forward Movement			
Fatigues Only	107.35 ± 37.68	178.33 ± 81.62	206.33 ± 85.87
Tactically Loaded	112.60 ± 44.37	126.43 ± 58.57	192.91 ± 60.33
Mobility Task			
Fatigues Only	128.23 ± 33.20	157.00 ± 70.41	274.08 ± 176.81
Tactically Loaded	108.70 ± 52.48	178.25 ± 70.11	212.08 ± 131.66

(Orr et al., accepted)

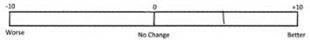


IMPACTS ON PERFORMANCE - MARKSMANSHIP

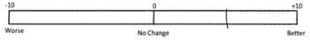
- Visual Analogue Scale (VAS)

Subject Number: _____

How do you think tactical load impacts on your marksmanship with the 200g when compared to carrying no load:




How do you think tactical load impacts on your marksmanship with the 200g when compared to carrying no load:



(Orr et al., accepted)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




IMPACTS ON PERFORMANCE - MARKSMANSHIP

- Perceived significant improvement in marksmanship when TL
 - Primary – VAS +3.00 ± 2.53 (p = 0.016)
 - Secondary – VAS +2.83 ± 2.93, (p = 0.039)
- Correlations between perceptions of load carriage impacts on performance and actual marksmanship scores
 - Primary: Short move: r = -0.347, (p = 0.500) and mobility task: r = -0.401 (p = 0.431)
 - Secondary: Short move: r = -0.631 (p = 0.179) and mobility task: r = -0.306, (p = 0.555)

(Orr et al., accepted)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

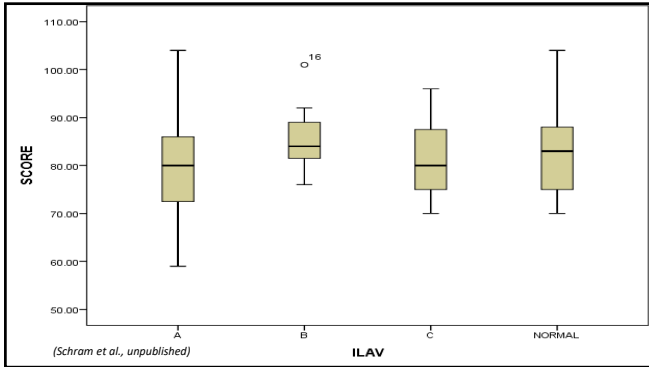


IMPACTS ON PERFORMANCE - MARKSMANSHIP

- GD police (n=11)
 - Average marksmanship scores (p=.118)
 - ILAV B – smallest SD,
 - ILAV A: a negative impact, -2.1 (95% CI -5.5 to +1.3)
 - ILAV B: a positive impact, +2.7 (95% CI +0.4 to +5.0)
 - ILAV C: a negative impact, -1.7 (95% CI -4.4 to +0.9)
 - Normal station wear: a positive impact, +1.4 (95% CI -2.2 to +5.0)

(Schram et al., submitted)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA










IMPACTS ON PERFORMANCE - MOBILITY

- Decrements in performance:
 - ↓ Mobility
 - Impeded mission success (Breen 2000)







TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA



IMPACTS ON PERFORMANCE - MOBILITY

- Victim Drag (10m)
- Police Vehicle Exit and Sprint (Schram et al., submitted)

Condition	Victim Drag	Vehicle Exit
	Time (s)	Time (s)
ILAV A	5.74±0.28	3.49±0.94
ILAV B	5.47±0.23	3.41±0.87
ILAV C	5.50±0.38	3.40±1.06
N	5.56±0.43	3.41±0.85



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA






IMPACTS ON PERFORMANCE - MOBILITY



	Unloaded	Loaded
10m sprint (sec)	2.40 ± 0.22	2.46 ± 0.15
10m dummy drag (sec)	6.89 ± 0.44	7.79 ± 0.75*
Total time (sec)	9.29 ± 0.53	10.25 ± 0.77*

* Indicates statically significant differences between unloaded and loaded, p<0.01.

(Carlton et al., 2014)





TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA






IMPACTS ON PERFORMANCE - POWER

(Dawes, Kornhauser, Holmes et al., submitted)

	Cohort		
	Male	Female	Cohort
	Mean ± SD (Range)	Mean ± SD (Range)	Mean ± SD (Range)
Age (years)	38.79 ± 7.57 (22 - 66)	38.36 ± 8.06 (22-66)	40.88 ± 7.68 (25-50)
Height (cm)	177.45 ± 8.36 (156.21 - 195.58)	179.53 ± 6.95 (165.10 - 195.58)	167.32 ± 7.49 (156.21 - 177.80)
Weight (kg)	88.61 ± 19.44 (51.71 - 154.59)	91.35 ± 18.20 (66.04 - 154.58)	75.22 ± 20.95 (51.71 - 118.16)
Absolute load (kg)	9.57 ± .94 (7.08 - 12.02)	9.61 ± .97 (7.08 - 12.02)	9.34 ± .81 (8.26 - 10.70)
Relative load (% of body weight)	11.19 ± 2.14 (5.93 - 17.02)	10.82 ± 1.87 (5.93 - 14.56)	13.00 ± 2.56 (8.41 - 17.02)

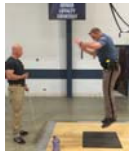

TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA





IMPACTS ON PERFORMANCE - POWER

	Cohort	
	Unloaded	Loaded
VI (cm):		
Cohort	49.49 ± 8.46	43.62 ± 7.68 [†]
Male	51.39 ± 7.50	45.32 ± 6.78 [†]
Female	40.22 ± 6.79	35.31 ± 6.54 [†]
PAPw (W):		
Cohort	4963.02 ± 879.17	5039.83 ± 913.92**
Male	5202.74 ± 708.75	5269.80 ± 773.37 [†]
Female	3794.38 ± 686.64	3918.69 ± 714.72 [†]
P-W (W/kg):		
Cohort	56.67 ± 6.41	51.66 ± 4.93 [†]
Male	57.72 ± 6.12	52.60 ± 4.58 [†]
Female	51.56 ± 5.52	47.03 ± 4.04 [†]

(Dawes, Kornhauser, Holmes et al., submitted)

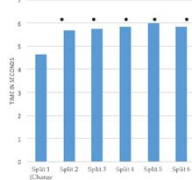
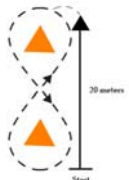



TSAC ANNUAL TRAINING
 APRIL 2 - 5, 2018 | NORFOLK, VA

BOND UNIVERSITY
NATIONAL RESEARCH CENTER

IMPACTS ON PERFORMANCE - AGILITY

(Dawes, Kornhauser, Holmes, et al., submitted)




Split	Time in Seconds
Split 1 (Change Phase)	~4.5
Split 2	~6.5
Split 3	~6.5
Split 4	~6.5
Split 5	~6.5
Split 6	~6.5

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

BOND UNIVERSITY
NATIONAL RESEARCH CENTER



TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION


BOND UNIVERSITY
NATIONAL RESEARCH CENTER

Example: Active Shooter Resulting from a High Risk Warrant Execution

(Robinson, Irving, et al., 2015)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA


NSCA
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION



Example: Physical Assessments to mimic physiological stress encountered during key tasks-SPURT

(Robinson, Irving, Orr, et al., 2015)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA




PRACTICAL APPLICATION - Conditioning

- Tactical personnel need to be reconditioned to carry loads following injury as part of a RTW process
 - F (7-10 days),
 - I (loads required),
 - T (work duration),
 - T (Load carriage / combined RT & Aerobic)

(Orr et al., 2010; Knapik et al., 2012)

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

Measure	Pack March 1 (min:sec)	Pack March 2 (min:sec)	Pack March 3 (min:sec)
Pack March 1 (min:sec)	1	.840**	.815**
Pack March 2 (min:sec)	.840**	1	.881**
Pack March 3 (min:sec)	.815**	.881**	1
Body Weight (kg)	0.097	0.010	0.081
1 RM Bench Press (kg)	-.360*	-.318*	-.295*
Bench Ratio (%)	-.465**	-.365*	-.379**
1 RM Squat (kg)	-.401**	-.335*	-.316*
Squat Ratio (%)	-.500**	-.381**	-.396**
1 RM Deadlift (kg)	-.288*	-.0248	-.0215
Deadlift Ratio (%)	-.403**	-.294*	-.305*
1 RM Pull up (kg)	-.452**	-.439**	-.416**
Pull up Ratio (%)	-.607**	-.512**	-.541**
Vertical Jump	-.501**	-.541**	-.523**
Shuttle Run (Level)	-.712**	-.709**	-.711**
10 meter sprint	.373*	0.178	0.217



** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).



BOND UNIVERSITY
Tactical Research Unit

PRACTICAL APPLICATION - Conditioning

- Tactical personnel need to be reconditioned to carry loads following injury as part of a RTW process
 - F (7-10 days),
 - I (loads required),
 - T (work duration),
 - T (Load carriage / combined RT & Aerobic)
- Must RTW stronger than when they were injured

(Orr et al., 2010; Knapik et al., 2012)

NSCA
NATIONAL STRENGTH AND
CONDITIONING ASSOCIATION

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA

BOND UNIVERSITY
Tactical Research Unit

Load Carriage across Tactical Personnel: Green, Blue and Red

Dr Rob Orr (PhD, PHTY, BFET, TSAC-F, ADFPTI)

<https://bond.edu.au/tru>

rorr@bond.edu.au

NSCA
NATIONAL STRENGTH AND
CONDITIONING ASSOCIATION

TSAC ANNUAL TRAINING
APRIL 2 - 5, 2018 | NORFOLK, VA
