INTRODUCTION
Ambulation is a basic necessity for human independence. People must be able to start, maintain and then finally terminate their gait safely. Problems may arise when people who are elderly, disabled or have neurological disorders attempt to terminate their gait [1, 3]. Some studies have focused on EMG and kinematics to describe gait termination but the purpose of this study was to quantify the joint kinetics during planned gait termination.

METHODS
Eighteen subjects (9 female, 9 male) participated in the study. Subjects were asked to walk five times with a natural cadence and come to a stop on two side-by-side force platforms (Kistler). A third force platform quantified the penultimate step. The forces and motion data were collected using a Vicon system with 6 Vicon MX13 cameras. Figure 1 shows the walkway layout. The kinematic data were combined with force platform data by inverse dynamics to determine the net moments and powers at the ankle, knee and hip in both left and right legs using Visual3D [2]. Data were ensemble averaged and normalized to body mass for inter-subject comparisons.

RESULTS AND DISCUSSION
Figure 2 shows data from a typical subject’s lead leg during planned gait termination. The lead leg contributed the main braking force to the termination process. The termination process begins with a dorsiflexor moment at the ankle that controls foot slap but quickly switches to negative work done by the plantar flexors. The knee extensors provided the highest peak powers while performing negative work immediately after heel-strike. This burst is briefer than the ankle plantar flexors and therefore dissipates less energy than the plantar flexors. The hip flexors provided the least energy dissipation, the least peak powers and the most variable patterns of the three moments.

The trail leg’s main goal in gait termination is to bring the trail leg parallel with the lead leg while dissipating any remaining forward momentum. To accomplish this function the trail leg’s moments of force act similar to what they do during normal walking gait. The dorsiflexors act briefly to control foot-slap after terminal heel-strike followed by negative and then positive work from the plantar flexors. The knee flexors act eccentrically but briefly after heel-strike followed by a positive period during “midstance” and a relatively larger burst of negative work that dissipates the largest amount of energy of any of the lower extremities moments of force. The hip flexors also dissipate energy immediately after heel-strike but switch to positive work to extend the hip joint to its final standing orientation.

SUMMARY
Planned gait termination is a process that requires specific functions from the moments of force of both lower extremities. The lead leg’s ankle plantar flexors, knee extensors and hip flexors dissipate forward momentum while the trail leg’s knee extensors and hip flexors dissipate energy from the trail leg before quite stance is accomplished.

REFERENCES